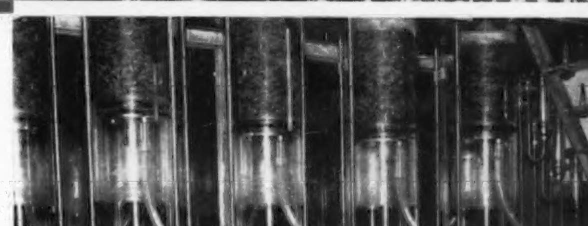
DECEMBER 1959

# Agricultural Engineering

The Journal of the American Society of Agricultural Engineers







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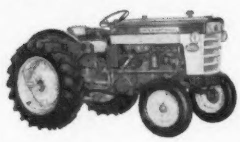

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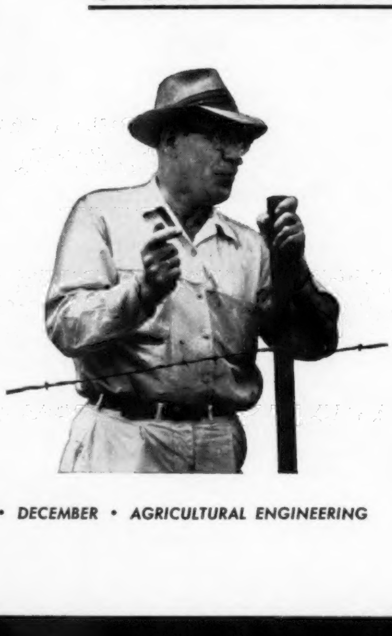

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# Agricultural Engineering

*Established 1920*

**CONTENTS • DECEMBER, 1959 • Vol. 40, No. 12**



**INDEX TO VOLUME 40**

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JAMES BASSELMAN, *Editor and Publisher*





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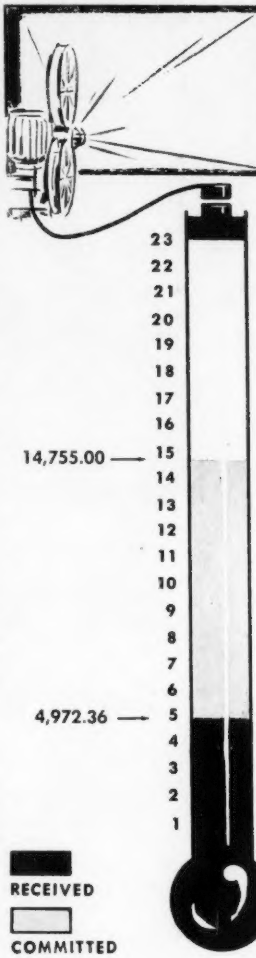
## Boosting ASAE Motion Picture

DURING the month of November cash received for the ASAE Motion Picture Fund swelled the black on the Motion Picture Progressometer with an increase of $1,136.40, bringing the total of cash received to $4,972.36. With no additional commitments made during the month the total of $14,755.00 remained the same, thus maintaining a total of $8,245.00 yet to be raised to meet the goal of $23,000.00.

Six additional Sections completed payment on their respective quotas – four of which oversubscribed. Latest to join the paid-up Sections are Virginia, Pacific Northwest, Iowa, Hawaii, Kentucky, and Minnesota, with Pacific Northwest, Iowa, Hawaii, and Kentucky oversubscribing. Although the Virginia Section does not go on record as oversubscribing its quota established for the present drive it did contribute $400.00 to the Motion Picture Fund in 1956. The Pacific Northwest Section was assisted in meeting its established quota by a contribution of $150.00 from the West Coast Lumberman's Association. However, since the Section was able to meet the assigned quota by ASAE member donations it elected to apply the special contribution as its oversubscription. The total of paid-up Sections amounts to 18 with a total of 10 oversubscribing their quotas.

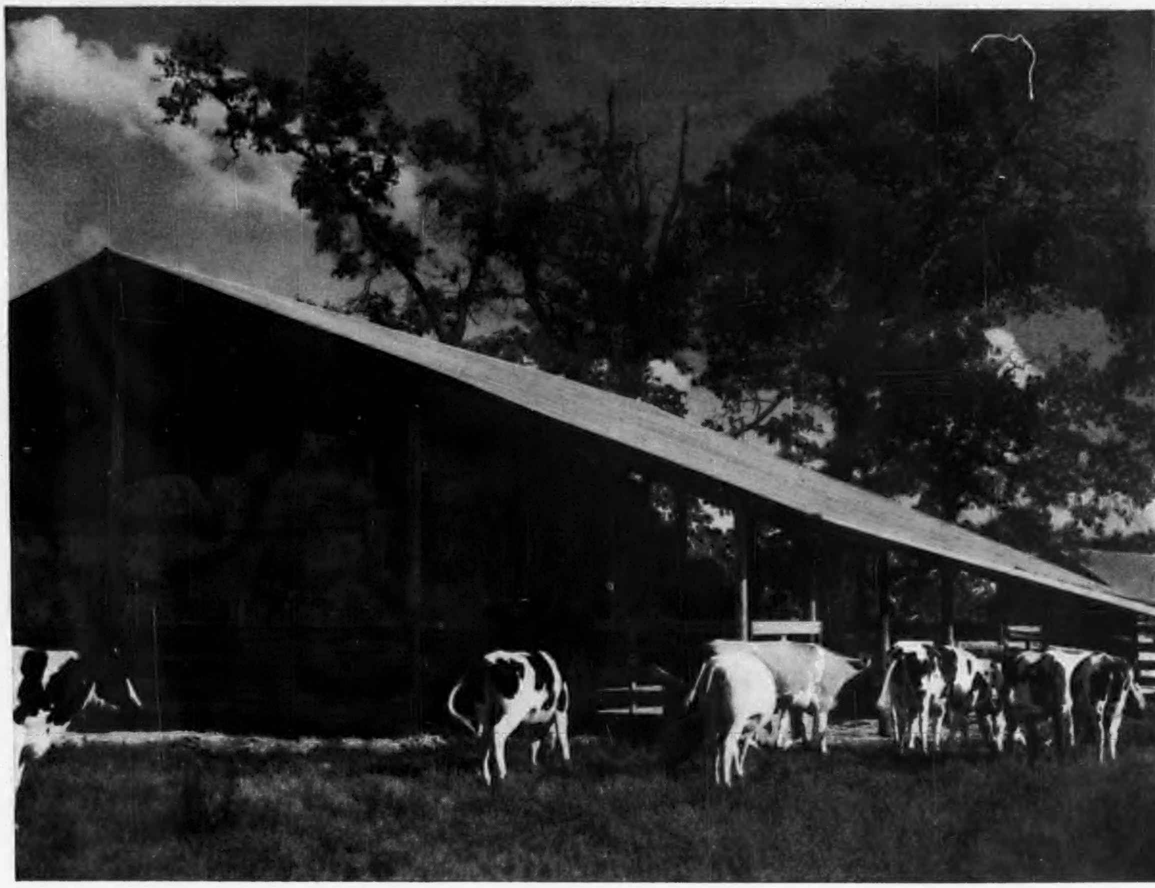



Of special note were two contributions from ASAE members who are residing outside of the United States.

Watch this column each month to observe the progress of the motion picture project.

## 1960 ASAE Membership Roster

IN order that the latest changes can be made in the 1960 ASAE Membership Roster to appear in the 1960 AGRICULTURAL ENGINEERS YEARBOOK, corrections must be received by February 1. For convenience in making corrections a clipping from the 1959 roster was attached to the 1960 membership dues invoice. Please make any necessary corrections when dues are paid. Those who find it necessary to delay payment of dues beyond February 1, are requested to return the bottom of the invoice with necessary changes. It is important also that information concerning employment or business affiliation be furnished as is requested on the dues invoice.



# Report to Readers . . .

**NEW THRESHING PRINCIPLE FOUND TO SEPARATE GRAIN FROM STRAW**

A patent has been granted to a Michigan State University agricultural engineer covering the design of a threshing mechanism that purports to incorporate a completely new principle for separating small grain from straw. . . . . Conventional threshing machines use a beating action to remove the grain from the heads, and two sets of shaker racks separate the grain and chaff from the straw and the grain from the chaff. In the new thresher, however, the heads of grain are taken into a conical separating cylinder, in which a rubbing action in combination with a whirling movement separates the grain from the heads. The centrifugal force developed by this whirling action drives the grain to the screened cylinder wall whence it passes through the screen, where a wind blast cleans the grain of any chaff that has passed through the screen.

**NEW PLANTING MACHINE HELPS SPEED UP SEED GERMINATION**

A new farm implement designed especially for planting cotton has been developed by agricultural engineers of Oklahoma State University. Called a "plateau profile" planter, it is being adapted also to the planting of grain sorghums, soybeans, peanuts, and castor beans. Preliminary results indicate that it will eliminate the several replantings of certain crops that are often required before satisfactory stands are obtained. . . . . The new planter consists of a ground-opening sweep, disks, seed-furrow opener and seed tube, seed-firming wheel, and an open-center drag, all mounted on a conventional planter. In operation this planter leaves the seed in a low, firm seedbed with a water furrow on each side and a higher protective ridge between the rows. The "plateau" in which the seed is planted is above any standing water, so that the soil warms up and the seed germinates faster.

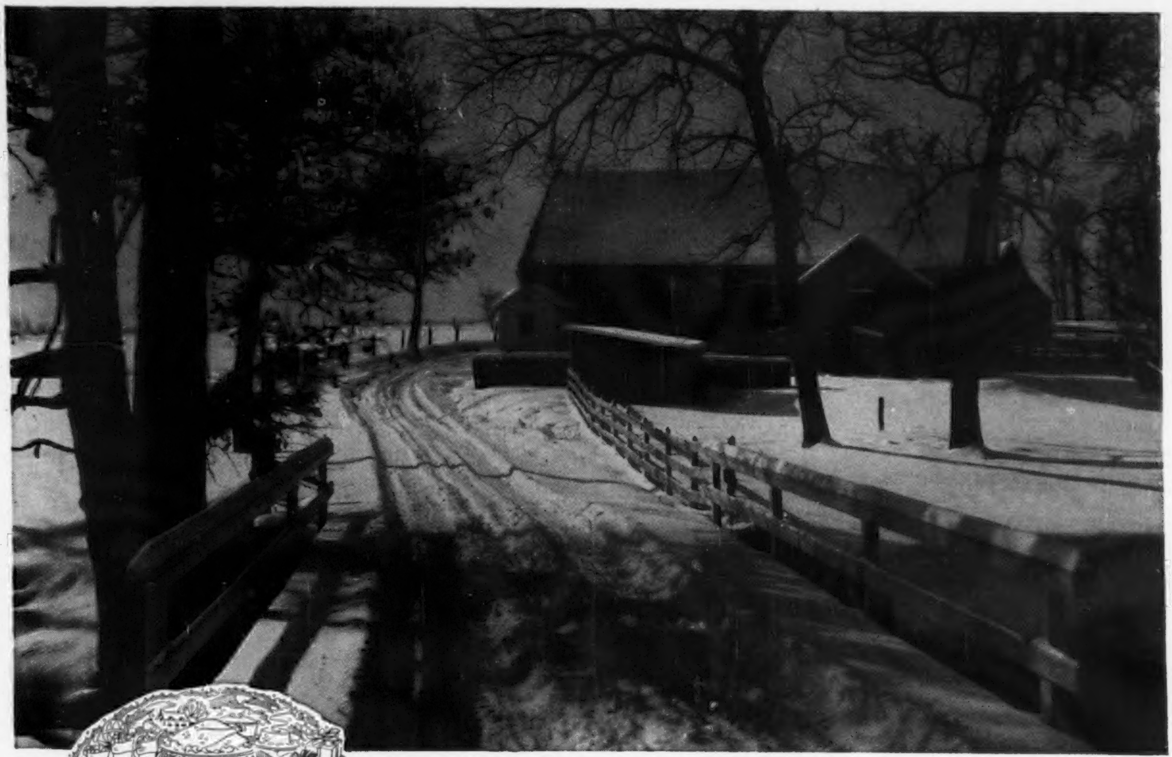
**FEEDLOT SEEN AS BEEF FACTORY WITH PRODUCTION-LINE METHODS**

This viewpoint was expressed by a North Dakota Ag College agricultural engineer in urging his professional colleagues to devote more attention to developing design requirements of feedlots for ease of handling feeds, economy of labor and efficient use of capital. Beef feeding has become big business and more mechanization is needed in handling feed for larger herds. But under some conditions the type of mechanization that uses complete self-contained, feed-conveying systems, including augers, drags and shuttles, may not be practical. Where more than one feedlot is in operation and varying rations are needed, self-unloading wagons with fenceline bunks may have a definite advantage, especially since one man may be able to feed up to 2,000 head per day with this arrangement. . . . . The location of the feed supply and the traffic pattern of the feeding equipment are other considerations in laying out a feedlot. Here sound planning can reduce unnecessary construction and operating costs.

**WEATHER DATA AS A GUIDE IN DESIGNING FARM CROP DRIERS**

Two Purdue AES agricultural engineers have been making a study of 25 years of weather data from US Weather Bureau stations in Indiana and neighboring states, their purpose being to provide the basic data needed for designing more efficient crop-drying systems. . . . . Mechanical crop drying is becoming popular because it makes earlier harvesting of crops possible and reduces weather risks. However, operation of driers using unheated air is affected by weather conditions: they have a high capacity when the weather is dry and hot and a lower capacity when it is humid and cold. . . . . The crop-drier designer needs to know how much help he can expect from the weather. With the weather information they have gathered, the Purdue engineers say that designers of crop driers can tell the probable amount of heat they can expect to be available for drying with natural air. This will enable them to size their designs for more economical operation.

*(Continued on page 720)*



TWELVE-INCH HAY CUBE vs CONVENTIONAL HAY BALE

That twelve-inch hay cubes may eventually replace conventional hay bales on many farms in the future is the prediction resulting from field studies this past season by University of Minnesota agricultural engineers. The small, 10 to 15-pound cubes are easier to handle mechanically and to dry artificially – also easier to move by conveyor from baler to trailing wagon and from wagon to barn mow. . . . . Drying the small bale is also easier, since in this form there is twice as much exposed area per pound of hay as in conventional bales. Also, nearly nine-tenths of the hay in a small bale is within 3 inches of the surface as compared to about two-thirds for conventional bales. As a result, all the hay in a small bale can be reached more easily with forced air. In fact, the engineers say the small bales should be mow-dried almost as easily as the same amount of hay in chopped form. Moreover, the small bales can be dropped and left where they fall in the mow. . . . . The Minnesota study is part of a complete haying system, involving cutting, conditioning, raking, baling, storage and drying.

WATER – A NATIONAL PROBLEM THOUGH NOT ONE OF SCARCITY

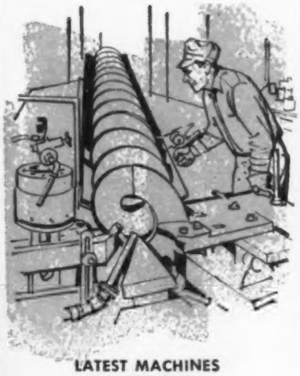
Something of a hue and cry is now and then heard in the land of an impending national water shortage. What about the rumors and reports of such a shortage? One writer puts the situation succinctly when he states: "The nation has a water problem – but not a water shortage. The problem is not that there is not enough water, but that the water is not controlled, used, and distributed properly." . . . . In the US the annual national average of water from precipitation is about 30 inches. Of this about 21 inches returns to the atmosphere by natural evaporation. Out of the remaining 9 inches only 3 inches is withdrawn from streams and the ground, and of these 3 inches only 1 inch is actually "consumed." The other 2 inches are used and return in some form to streams and reach the sea. The total that eventually reaches the sea is 8 inches, or 27 percent of the total income of water and 90 percent of the manageable supply. . . . . Viewed nationally the water problem is not one of quantity, since only one-third of the manageable supply is withdrawn, only one-tenth of which is actually used. Instead it is a problem of water management and use.

RESEARCH HELPS IMPROVE INSECT CONTROLS IN COTTON PRODUCTION

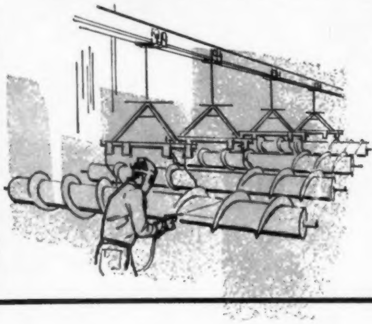
Significant improvements in the control of insects in the production of cotton are being made as a result of the combined research efforts of USDA agricultural engineers and entomologists. In the forefront of these advances are new spraying devices and methods. Side-mounted booms on trailing-type sprayers, for example, were found to give good results in spraying skip-row cotton in Mississippi. . . . . Promising results are reported, for both insect control and defoliation, from tests of a mist sprayer that airblasts fine spray particles across cotton plants to a width of 90 feet. . . . . Because of the importance of spraying cotton at planned intervals – sometimes immediately after rain to forestall new outbreaks of pests and diseases – the researchers are testing the use of low-pressure tires for providing surer footing of high-clearance sprayers in muddy fields. More efficient spraying has been made possible by improved pesticide distribution systems for both ground and aerial sprayers. Also, nozzle-placement studies have pointed the way to more precise coverage with less pesticide and less residue. . . . . Engineers have developed a nozzle system for spraying both the top and underside of leaves of cotton for better control of insects, including spider mites. The researchers are also giving special attention to developing better trap devices for survey work. . . . . Use is now being made of ultraviolet light to attract pests and to reveal just how many insects there are in an area and the time of emergence, which helps to determine the proper control required. The light is now in use as an attractant for both electrified grid traps and the new suction-fan traps that collect insects in a mesh bag.

# What LINK-BELT augers contribute to the design of your machines

GLEANER-BALDWIN COMBINE, product of Allis Chalmers Mfg. Co., uses Link-Belt auger with opposing flights for smooth, efficient grain harvesting. Other Link-Belt screw conveyors within combine elevate, convey and unload harvest.

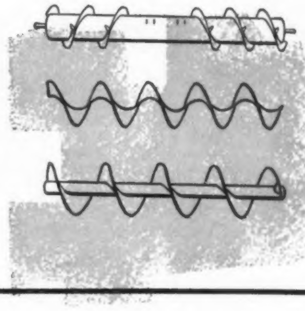


**LATEST MACHINES AND METHODS** assure auger uniformity, O. D. and I. D. are held to close tolerances. Sheets for tubing are jig punched, then rolled to be true round. Flighting is cold rolled for slip fit on tubing or pipe, and welded for permanent alignment.



**QUALITY "SAFEGUARDS"** make sure all Link-Belt augers are delivered in perfect operating condition. Straightness is carefully checked before shipping . . . painting prevents rusting . . . extra care is taken in handling, loading.

**SELECTED FLIGHTING** is available from Link-Belt to meet any auger application — helicoid, cut flight, short pitch, ribbon flight, double flight and many other designs — in the metal and finish best suited for your requirements.



## . . . and why they're the consistent choice of leading farm machine manufacturers

Simplicity, strength, exactness of construction—all are combined in Link-Belt augers to assure long-lived, dependable performance on your machine.

Every Link-Belt auger is a uniform, smooth, accurately rolled product . . . one sturdy, compact basic assembly fabricated to meet your requirements. Only selected steels are used, and Link-Belt's modern, specialized machinery achieves consistent flighting uniformity.

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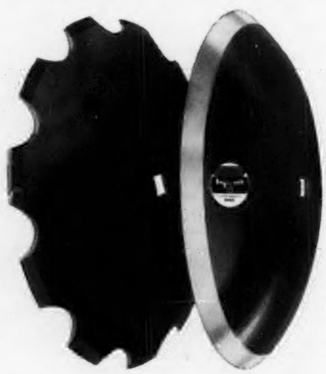
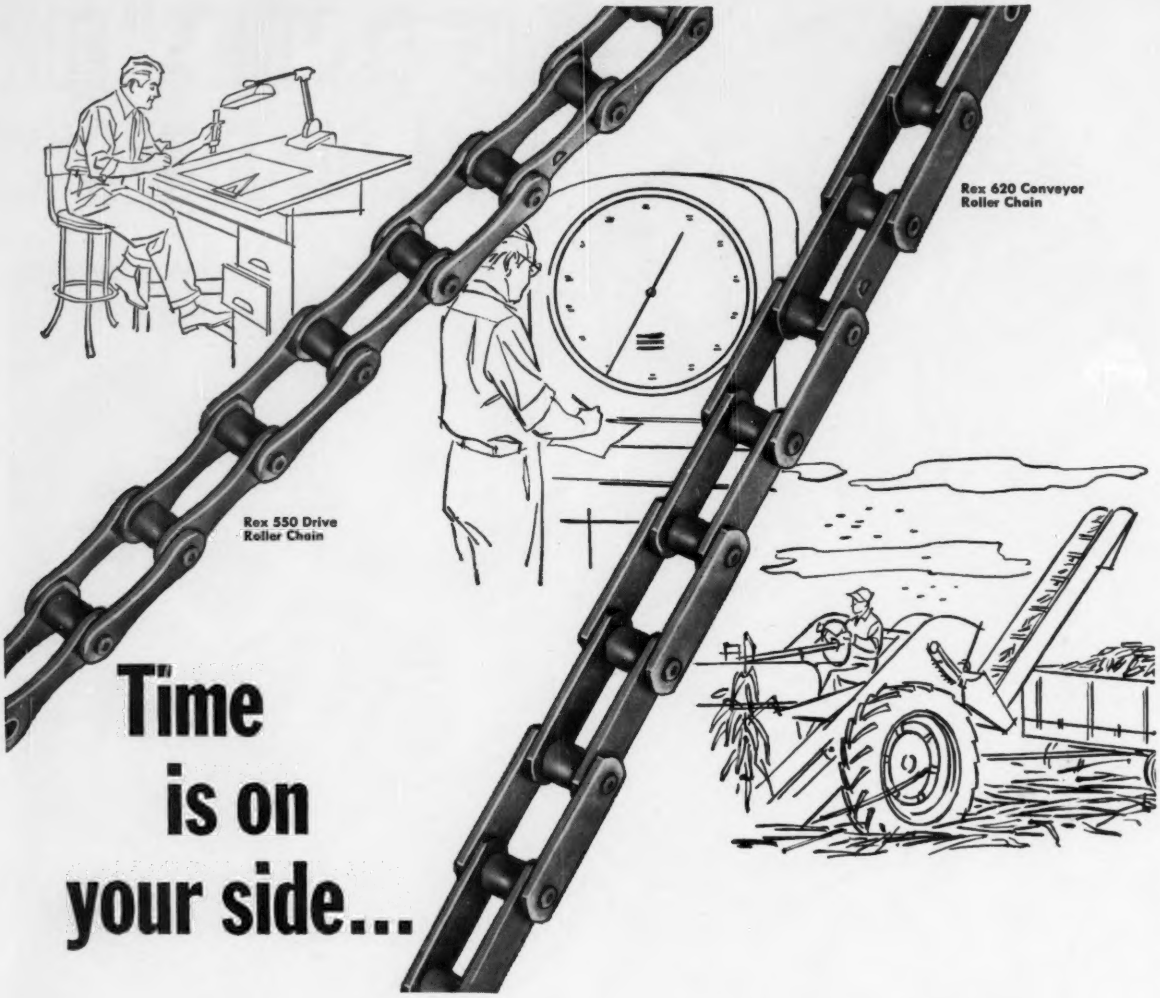
*Chopping orchard prunings with Ingersoll Dura-Notch® discs is easy work for the Case 300 Wheel-Type Harrow*



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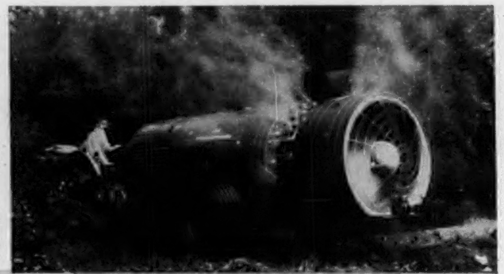
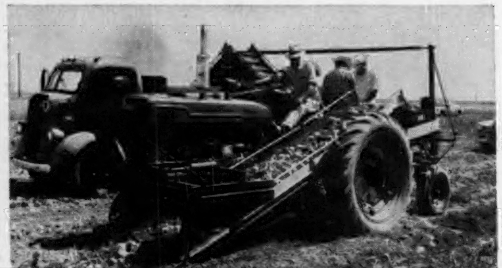


John Bean Orchard Speed Sprayer

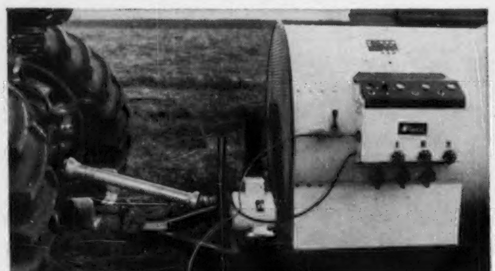
# You can sell specialized implements easier

Corsicana Rotary Cutter



Lockwood Potato Harvester

# . . . when they're equipped with rugged



Finco Crop Drier

Mathews Chopper-Hay Conditioner

# BLOOD BROTHERS P. T. O. DRIVE LINES

When you talk to farmer-customers, help clinch your sales by pointing out the genuine Blood Brothers Drive Lines. From long experience, farmers know and respect their dependable, lasting performance.

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ROCKWELL R STANDARD

BB UNIVERSAL JOINTS

**Blood Brothers Universal Joints**

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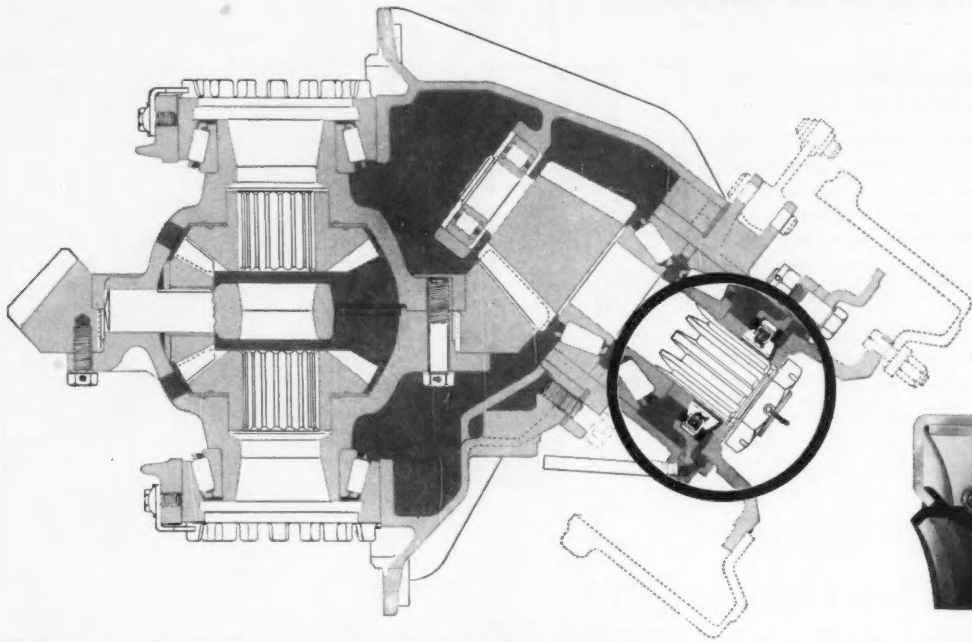
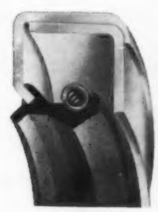
NATIONAL OIL SEAL® LOGBOOK

# for the Mack bus





# New design seal ends grooving, eliminates costly flange replacement on bus axle carrier

In early designs of the axle carrier assembly for the new Mack bus, a combination of high temperatures, EP oils hardening the sealing lip and a relatively soft sealing surface on the flange caused grooving. It was then necessary to replace the flange, an expensive procedure.

The problem was solved through application of a new National 410,000 series synthetic rubber oil seal. The special compound of the new-design synthetic rubber sealing lip is unaffected by either high temperature or EP lubricants. To positively insure that grooving will not cause flange replacement, an easily installed wear sleeve with synthetic rubber lining is provided.

In buses, trucks, tractors and machinery, as well as throughout American motor car manufacture, National seal engineers work with factory designers to provide better, less costly, more efficient lubricant sealing. This experience is yours at no obligation; simply call the National Seal engineer. Look under Oil Seals, in the Yellow Pages.

**NATIONAL SEAL**

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General Offices: Redwood City, California
Plants: Van Wert, Ohio; Redwood City and Downey, California

NATIONAL OIL SEALS

4625

# Agricultural Engineering

December 1959
Number 12
Volume 40

James Basselman, *Editor*

# PUBLIC RELATIONS ACTIVITIES TO BE EXPANDED

IN keeping with the current trend in all engineering societies, the public relations activities of the ASAE will be expanded in the very near future. The first positive step in this direction was taken by the ASAE Council in announcing that Harmon Mulbar, replacement for Raymond Olney as advertising manager for the Society's publications, would also devote a portion of his time to ASAE public relations.

The second step toward an expanded Society public relations activity has been announced by ASAE President L. H. Skromme through the appointment of an enlarged ASAE Public Relations Committee with over-all steering committee responsibilities, as well as specific working assignments.

The new Public Relations Committee will consist of a nine-man Steering Committee with C. E. Ball as chairman, G. A. Karstens as vice-chairman, and Harmon Mulbar as secretary. The remaining six members of the committee will be the chairmen and vice-chairmen of the three public relations working committees.

The new working committees have been organized to provide needed assistance in three important areas of ASAE public relations. These committees will hold their first meeting during the forthcoming Winter Meeting of ASAE in Chicago and will set up specific objectives and procedures at that time. ASAE members and sections will be called upon to support these efforts and activities in order to achieve the objective of bringing the Society and agricultural engineering to the attention of the various publics which they serve. Further details will be forthcoming after the over-all program has been developed and the mechanics of operation have been established. The three working committees with current membership are as follows:

**Committee on National Public Relations**

G. A. Karstens, Chairman
K. L. Pfundstein, Vice-Chairman
Harmon Mulbar, Secretary
Nevin Brenner
D. P. Brown
S. D. Coleman
W. E. Eakin
Irby S. Exley

**Committee on Section Public Relations**

E. D. Wilborn, Chairman
J. K. Jones, Vice-Chairman
Harmon Mulbar, Secretary
William B. Haley
Walter Grub
B. F. Parker
F. L. Rimbach
Albert A. Zander

**Committee for National Meetings Publicity and Public Relations**

T. E. Clague, Chairman
J. H. Wessman, Vice-Chairman
Harmon Mulbar, Secretary
L. L. Boyd
S. S. DeForest
E. S. Judy
R. C. Miller
Carroll Worlan

## Engineering B.S. Degrees — 1959

FOLLOWING are estimates of engineering B.S. degrees for 1959 and those forecast for 1960 by the Engineering Manpower Commission of Engineers Joint Council released November 2. Official 1959 figures are expected to be published by the U.S. Office of Education in the near future.

| From colleges with ECPD accredited curricula | 1958 Actual | 1959 Estimated | 1960 Projected |
|---|---|---|---|
| Aeronautical | 1188 | 1300 | 1285 |
| Agricultural | 359 | 360 | 350 |
| Chemical | 2920 | 3025 | 2975 |
| Civil | 4673 | 5050 | 4975 |
| Electrical | 8712 | 9500 | 9400 |
| General | 683 | 710 | 685 |
| Industrial | 1783 | 1875 | 1825 |
| Mechanical | 7859 | 8425 | 8350 |
| Metallurgical | 662 | 680 | 670 |
| Mining | 220 | 205 | 190 |
| Petroleum | 680 | 685 | 660 |
| All others | 1477 | 1800 | 1750 |
| Total | 31216 | 33615 | 33115 |
| From other colleges | 4116 | 4350 | 4300 |
| Grand Total | 35332 | 37965 | 37415 |

Data for 1959 and 1960 represent scaling down of earlier estimates because retention rates in recent years have decreased. The 1959 graduating class (close to 38,000) started in 1955 with 72,825 freshmen; although the freshman class in the following year (1956) was larger (77,738) it now appears likely that the number graduating (four years later) will be smaller. Within the past five or six years the trend in degrees by curricula distribution have shown: Electrical gaining steadily; Civil dropping while Agricultural, Mechanical, Chemical and Industrial have remained fairly constant.

An earlier report indicated that freshman engineering enrollment declined in the fall of 1958 for the first time in eight years and it was estimated that the decline would continue in 1959. A report from the ASAE Committee on Student Recruitment has stated that Agricultural engineering enrollment has followed the same trend.

Fig. 1 Two corn pickers and two combines with corn attachments were compared in the experiment

# Experiments in Harvesting Dwarf Corn

G. E. Pickard and H. P. Bateman
Member ASAE Member ASAE

***Investigators of dwarf corn harvesting procedures outline requirements for plant breeders and farm machinery designers***

DWARF corn appeals to many farmers and engineers as a possible means of getting away from the corn picker with its high harvesting losses and its injury hazards. Very short corn that could be combined with a regular grain header offers greater convenience, lower investment, and probably a further reduction in harvesting losses. In addition, dwarf corn hybrids have shown a remarkable resistance to ear droppage and to root and stalk lodging that can often make a worth-while difference in the amount of corn recovered.

### What Is Dwarf Corn?

Geneticists describe three types of dwarf corn(1)*:

The *true dwarf* is short and compact with thickened, erect leaves and a grossly aberrant general appearance. Sex reversal is common in ear and tassel. This type tends to require a long growing season—and does not appear to offer any promise for development as a commercial hybrid.

Paper presented at Winter Meeting of American Society of Agricultural Engineers, Chicago, Illinois, December 1958, on a program arranged by the Power and Machinery Division.

The authors—G. E. PICKARD and H. P. BATEMAN—are, respectively, professor (deceased) and assistant professor of agricultural engineering, University of Illinois, Urbana, Illinois.

*Numbers in parentheses refer to appended references.

The *reduced plant type* is simply smaller than normal hybrids, and its small size applies to ears and kernels as well as to stalks and leaves.

The *brachytic-2 gene type* is distinguished by a marked shortening of the internodes, especially below the ear, without a corresponding reduction in size of the other major plant parts(1).

Plant breeders of the Illinois Experiment Station have been crossing dwarfs of the brachytic-2 gene type with inbreds from which a conventional hybrid, US-13, was derived. They have developed new dwarf hybrids by a program of alternate selfing and backcrossing and selection of most promising resulting strains. Commercial corn breeders have been carrying on parallel developmental work with other dwarf lines.

### Performance of Dwarf Corn

The brachytic-2 gene hybrids grow 4 to 7 ft tall (1). Ears are located from 10 to 30 in. above the ground, depending on the ancestry of the particular cross. The principal characteristic is usually strong resistance to root and stalk lodging. In three test fields in 1957 where 50 percent of the normal corn was lodged, there was no lodging in two fields of dwarf corn and only 4 percent lodging in the third field(1).

In so far as yield is concerned, the dwarfs still have a long way to go. In 1957 ten Illinois test fields showed dwarf corn yielding 91 percent(1) as much as normal hybrids. In 1958 the yield was down to about 85 percent(2), apparently as the result of a blight. Certain farmers' experiences with dwarfs developed by the University of Illinois and others were similar(3). Dwarf breeding is, however, in its infancy, and there is reason to believe that geneticists can eventually develop dwarf hybrids whose yields will approach those of normal hybrids. In the meantime the greatly improved standability and certain other features, such as reduced ear droppage, make the dwarfs attractive even with a 10-bu decrease in yield.

1958 ILLINOIS DWARF-NORMAL CORN TESTS*
(Average for five hybrids in each type at seven different test areas)

| | Lodged, percent | Stand, percent of planted | Average ear height, inches | Average plant height, inches | Detached ears, percent | Yield, bu per acre |
|---|---|---|---|---|---|---|
| Normal | 5 | 83 | 42 | 90 | 4 | 98.3 |
| Dwarfs | 2 | 87 | 19 | 57 | 1 | 84.2 |

*Experiments conducted by Department of Agronomy, University of Illinois.

CORN PERFORMANCE, HARVESTABILITY TEST PLOTS
(Agricultural Engineering Farm)

| Year | Type of corn | Time of harvest | Lodged, percent | Kernel mois-ture, percent | Popula-tion total, 1000 per acre | Detached ears, percent | Yield, per acre |
|---|---|---|---|---|---|---|---|
| 1957 | Normal | Early | 5 | 26 | 11.6 | — | 119 |
| | Normal | Late | 19 | 21 | 11.8 | — | 119 |
| | Dwarf | Early | 1 | 26 | 11.8 | — | 103 |
| | Dwarf | Late | 2.5 | 22 | 11.8 | — | 103 |
| 1958 | Normal | Early | 9† | 19 | 12.2 | 1.1 | 102 |
| | Normal | Late | 25† | 16 | 12.4 | 2.7 | 99 |
| | Dwarf | Early | 10† | 21 | 12.1 | 0.3 | 87 |
| | Dwarf | Late | 22† | 17 | 11.6 | 0.6 | 84 |

†Heavily attacked by stalk rot.

## Harvesting Experiments

Harvesting experiments with dwarf corn at Illinois have two main objectives: *(a)* to determine the machinery problems that may arise in harvesting dwarf corn with present equipment and *(b)* to explore the possibilities of adapting a regular small-grain combine header to dwarf harvesting without affecting its use for other crops. In the tests, both dwarf and normal corn was planted in four replicate plots for early and late harvesting with two corn pickers and two combines. One combine used a snapping attachment; the other was a cutoff machine. Mid-October and November 10 harvest dates were used.

In 1957 the dwarf corn stood remarkably well (about 97.5 percent compared with 81 percent for normal corn at the November harvesting date). However, in 1958 a severe stalk rot condition attacked both dwarf and normal corn, causing both to lodge. The dwarf corn showed reduced ear droppage before harvest, but higher ear loss caused by the machines at harvest nullified this advantage.

The over-all losses shown in Fig. 2 indicate that present machines are not too well adapted to harvesting dwarf corn. Shelled corn losses were higher in the dwarf hybrids than in normal corn because some of the ears of the dwarf corn were so low on the stalk that they caught between the tapered lower ends on the snapping rolls. An ear with its tip almost touching the ground is difficult to handle. Note that dwarf corn losses were slightly higher than those in the normal hybrids even though lodging was much less.

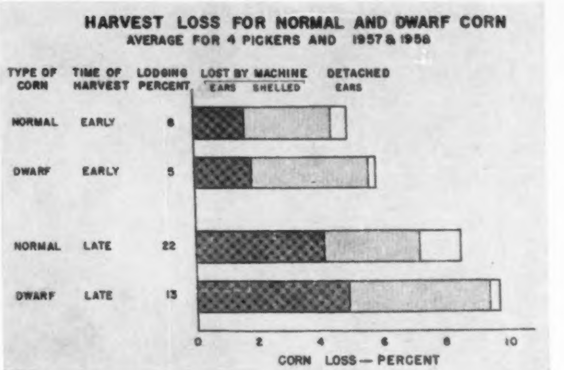


Fig. 2 Harvesting losses in dwarf corn are high. Excessively low-growing ears are often crushed by the snapping rolls

Statistical analysis of the ear losses resulting from use of all four machines showed that only the difference in loss between early and late harvest was significant. This higher ear loss affected the total loss, which also was statistically significant.

## Shelled Corn Losses

Fig. 3 shows that the shelled corn loss in normal corn also varies with the type of machine that is used. The cutoff gathering attachment reduced losses due to the absence of snapping rolls, but higher separating and shelling losses in the combine outweighed this advantage. For dwarf corn, on the other hand, the roll system was at a disadvantage because of the low ears. Although with the roll-type machine late-harvest losses are higher than early losses (which is the usual result), with the cutoff machine the late-harvest losses were lower because of the reduction in loss at the cylinder and in separating.

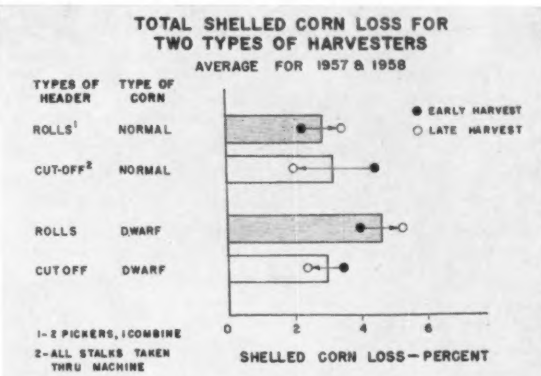


Fig. 3 The cutoff system of harvesting reduces shelled corn loss. Late-harvest loss is low

Only with machines having picking rolls were shelled corn losses significantly higher for dwarf corn than for normal corn. These high losses with the roll-type ma-

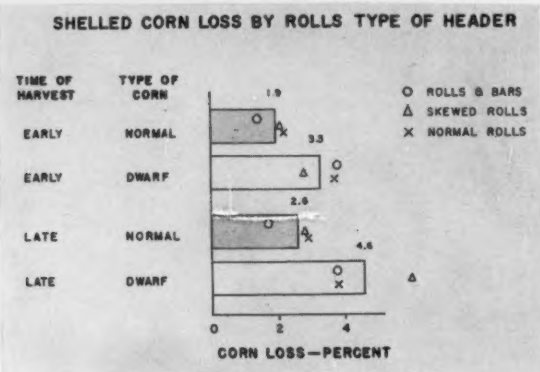


Fig. 4 Low ears of dwarf corn were pinched by the snapping rolls. The snapping-bar system shelled somewhat less corn

chine and the fact that the losses increased at late harvest make it apparent that the present picker system is not very satisfactory for dwarf hybrids.

The difficulty in handling the very low ears of some dwarf corn plants with a snapping system is demonstrated by the shelled corn losses shown in Fig. 4. Twenty-five percent of the tips of the ears were within 6 in. of the ground. In three out of four tests, however, the snapping bar design showed an advantage over the regular picker rolls.

The losses in dwarf corn are significantly higher than those for normal at both harvest dates.

### Combine Plus Cutoff System

The results shown in Fig. 5 indicate that the combine with a cutoff system shows promise for harvesting dwarf corn. Total loss was only slightly over 4 percent compared

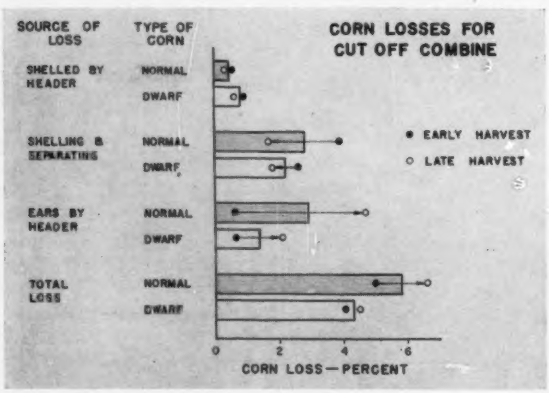


Fig. 5 The small plants of dwarf corn are an advantage in harvesting with a cutoff combine system

with an average of nearly 6 percent for all machines in normal corn. It will be noted, too, that in dwarf corn date of harvest had little effect on over-all loss with this machine. Ear loss in particular was below normal, apparently because the dwarf stalks were whipped less by the gathering units.

Early in the season the separating loss was higher when the whole plant was taken through the combine than when only the ears were processed. The small plants caused somewhat less load on the separating mechanism, with a resulting reduction in loss. Later in the season, however, these differences did not show up.

In summary it would appear that while present picking and snapping machines increase the shelled corn loss in dwarfs because the ears are so low, the over-all losses of 5.6 percent at early harvest and 9.4 percent at late harvest are not unusually high. The distinct superiority of the cutoff principle in harvesting dwarfs lends encouragement to future work of adapting the combine to harvest these hybrids without the need for a special header and with the advantage of handling three or more rows at a time.

### Experiments with Grain Header

Late in 1958 some exploratory attempts were made to harvest dwarf corn with a conventional auger-type grain header. In all experiments in which a reel was used, half of the plot was topped at 42 in., just above the highest ears. It became immediately apparent that with any reel of reasonable diameter the plane of the bat must be as nearly vertical as possible when entering the crop to avoid breaking the stalks down to the point where the cutterbar would miss the ears. Therefore, the adjustable bats were set at a wide angle to the reel arms.

Because the regular 32-in.-diameter reel was too small for even the topped corn, a three-bat 64-in. reel was installed. After one run it was changed to a four-bat reel, and the speed was reduced to maintain a reasonable ratio of peripheral speed to travel speed. It was impossible to use this reel as far back as was desirable, so its diameter was reduced to 43 in. Operating this reel directly over the cutterbar with the bats passing about 14 in. above it gave the best results of the trials up to this stage.

At this point the reel was removed and the header was equipped with experimental pans provided by the manufacturer of the combine. This device, which produced losses about equal to those with the reel, was also used in normal corn, and here the losses were only half as large. Experiments with this attachment will be continued next year.

Following trials with the pans, the 43-in. reel was put back on, and an extension plate designed to move the cutterbar forward 5 in. was installed. It appeared that there might be some advantage in providing extra space ahead of the auger to allow the corn to fall sidewise for entry under the auger. A shield provided with the extension was found

Fig. 6 The most satisfactory reel was 43 in. in diameter, and the bats were set to be in a vertical plane when entering the crop

Fig. 7 This pan attachment showed some promise

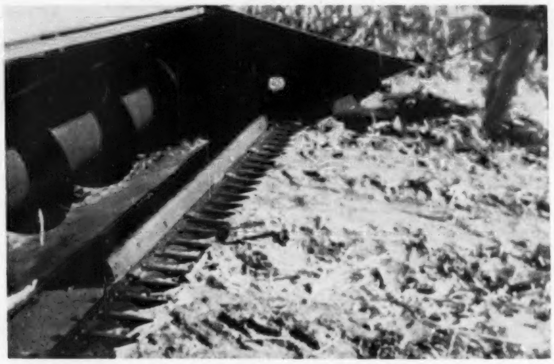

Fig. 8 Extending the cutterbar reduced ear losses, but the shield behind the sickle hindered progress of the corn from the sickle to the auger

to hinder the backward movement of the stalks after they were cut off, so this part was removed. It appears, though, that there would be advantage in tilting the extension up at the front to speed up the backward movement of the cut-off stalks and clear the cutterbar for incoming stalks.

Trials with this extended cutterbar included runs in corn that had had pre-emergence sprays of Simazine and that had not been cultivated. The crop was clean and the soil surface at harvest was very smooth, with no ridging of the rows. Some of this corn was planted in rows 20 in. apart.

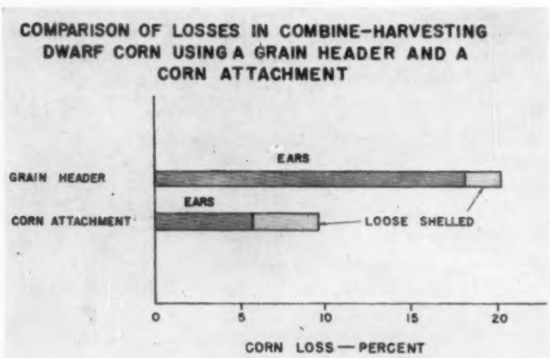


Fig. 9 The grain header will require a considerable amount of alteration to adapt it to dwarf corn

## Losses with Grain Header

Fig. 9 shows that the grain header can hardly be considered satisfactory, in its present design, for harvesting dwarf corn. Loose shelled corn and ear corn losses taken together were more than double those with a corn attachment. Although shelled corn loss was only slightly more than half as large with the grain header as with the corn attachment, each corn loss was very high. These figures are for tests on cultivated corn with normally ridged rows.

Since shelled corn losses were small and little affected by changes in the machine, the comparisons shown in Fig. 10 are for ear corn losses only. Use of the extended cutter-

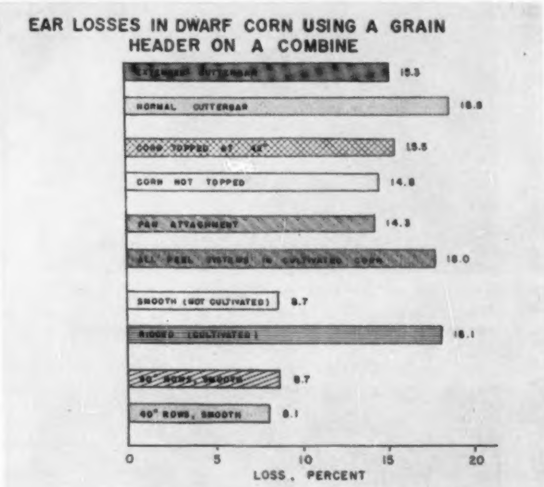


Fig. 10 The extended cutterbar and the pan attachment show some promise. Topping the corn was of no benefit. A smooth soil surface reduced losses by nearly 50 percent

bar gave some benefit. At least under the conditions of these tests topping gave no advantage. This chart also shows some possible advantage of the pan attachment over the reel system, but the inconvenience of installing and removing such a device make it undesirable if the regular reel system suitable for small grains can be used.

In addition, this chart shows the great importance of having a level surface that will permit the cutterbar to run close to the ground at all points. Finally, it appears that row spacing has no effect on ear corn losses.

## Conclusions

From the results of tests with picking and snapping machines in harvesting dwarf hybrids, it appears necessary to devise means to prevent excessive shelling of the very low ears. To make picking easier, a dwarf that has more uniform ear height is needed.

The good standability of dwarf hybrids helps to reduce harvesting losses, particularly late in the season.

A cutoff harvesting system is especially effective for harvesting dwarf corn. When a grain header with reel is used to harvest dwarf corn, it appears desirable to: Use tilted reel bats; Use a reel about 45 in. in diameter; Set the reel over the cutterbar with the slats passing about 14 in. above it.

In ridged (cultivated) corn, ear losses are excessive;

*(Continued on page 745)*

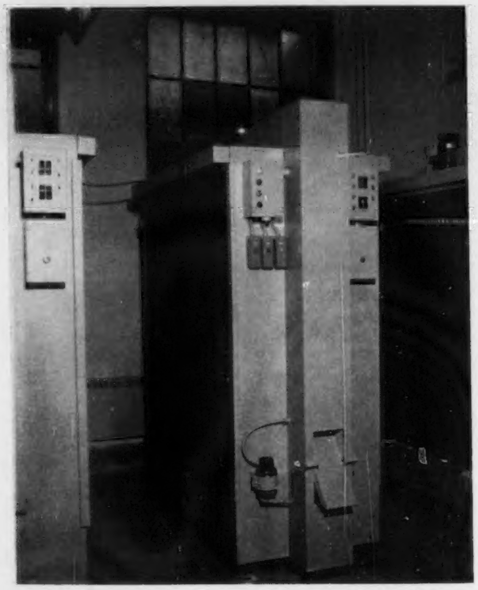

Fig. 1 Laboratory silo unit containing nine individual silos enclosed in a temperature controlled cabinet. This is the air temperature control end of the master unit. Blackout curtains exclude light

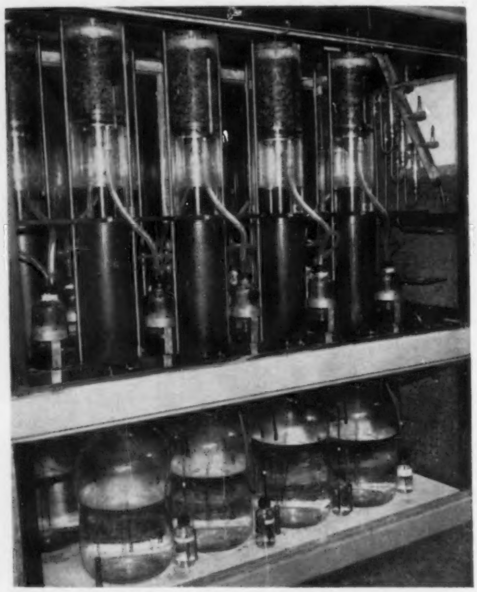

Fig. 2 *(Above)* Interior of master unit showing lucite silos, with silage samples under pressure of pistons actuated by air cylinders below. Manostats controlling pressures for all three units are at the upper right. Juice collection bottles stand next to air cylinders. Gas collection bottles and $NO_2$ detection bottles are on the shelf at the bottom

Fig. 3 *(Right)* Diagram of silo and auxiliary equipment. A slight vacuum is maintained by a syphon outlet from the large gas collection bottle

# The Laboratory Silo:

## A Tool for Silage Research


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MUCH of our present knowledge of silage making has been accumulated through the use of large silos, but such studies have limitations due to the many variables involved. Suppose we start to fill a 14 by 45 ft silo with alfalfa in ideal condition. It takes at least four days to fill the silo. The crop is maturing, so the material on top is not the same as that on the bottom. Several fields may be used in filling this silo, each with slightly different growing conditions. Moisture content of the green material may vary considerably during silo filling, particularly if the material is wilted in the field. Preserva-


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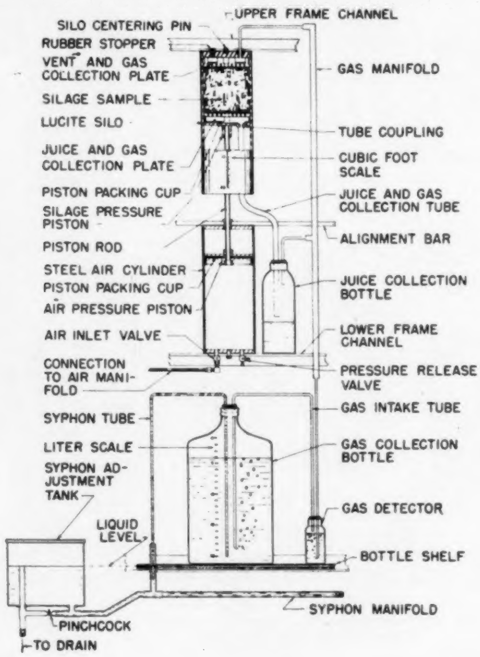
The authors—C. K. OTIS, J. H. POMROY, and D. GAWRELUK—are respectively, professor, instructor, and former research assistant in agricultural engineering, University of Minnesota, St. Paul.



*Acknowledgments:* Development of the equipment described in this article was made possible through two research projects: one, a cooperative project between the Minnesota Agricultural Experiment Station, the University of Minnesota School of Public Health, and the U.S. Public Health Service, dealing with nitrogen dioxide production in silage, and the other, 1203RH of the Minnesota Agricultural Experiment Station, a contributing project to regional Farm Structures Project NC-23. Although many others have participated, active cooperators in this joint venture were L. M. Schuman of the School of Public Health; J. V. Scaletti of the animal husbandry department; R. A. Briggs, agronomy and plant genetics department; and J. J. Jezeski, dairy bacteriology department, all of the University of Minnesota. The equipment described was designed and constructed by the agricultural engineering department with machining by E. E. Pose.

## *Agricultural engineers design and construct laboratory equipment to speed silage research*

tives are difficult to distribute uniformly so that their effect is hard to determine.

### Evaluating the Variables

To evaluate such variables, small samples could be used if a sufficiently uniform environment could be provided. Laboratory control plus adequate replications could make analysis of results by statistical methods meaningful.

The laboratory silo has been used in many forms for silage research. Virtanen's process (2)* for making silage by adding inorganic acids was based on work with laboratory silos. Workers at the Ohio Agricultural Experiment Station (4) used laboratory silos to determine densities and losses under controlled pressures. Cornell workers have used silos containing 60 to 100 lb of crop for studying the effect of various treatments on the resulting silage (6). Agricultural Engineers at Minnesota have used laboratory silos for studies of physical properties of silage (8). USDA studies (9) utilized larger silos in which variations in the extent to which atmospheric oxygen was included or excluded were provided and provision was made for weighing the contents of some of them. These are but a few of the many schemes to bring study of silage making into the laboratory.

The laboratory silos, described here, provide for more control of external conditions and for variables involved in silage making than is provided by equipment used in the past and, therefore, will enable a more precise evaluation of the effect of these conditions on the ensiling process. The silos were built to study the factors influencing the production of $NO_2$ gas in silage after several deaths in Minnesota in the fall of 1955 focused attention on the danger of this gas to farmers (7). A joint project involving the Minnesota Agricultural Experiment Station, the University of Minnesota School of Public Health, and the U. S. Public Health Service was activated to study the problem. To aid in determining what causes this lethal gas to form during silage fermentations, laboratory silos provide environments assumed to exist in large silos (3). By pooling the resources of two research projects our laboratory silo equipment was designed, constructed, and put in operation. Although their first use has been in the study of the production of $NO_2$ gas in silage, there are many silage making problems that can be studied with these silos. Among these would be:

*(a)* Silage density and juice flow as affected by length of cut, moisture content, pressure, maturity of the crop, type of crop and time.

*(b)* Density depth relationships can be predicted in the laboratory for silages when sidewall friction factors are known.

*(c)* Friction forces between various silages and sidewall materials and the relationship of lateral and vertical pressures at various vertical pressures.

*(d)* Comparative quality of silage as affected by fermentation temperature, pressure, exposure to light, preservatives, and other factors.

*Numbers in parentheses refer to appended references.

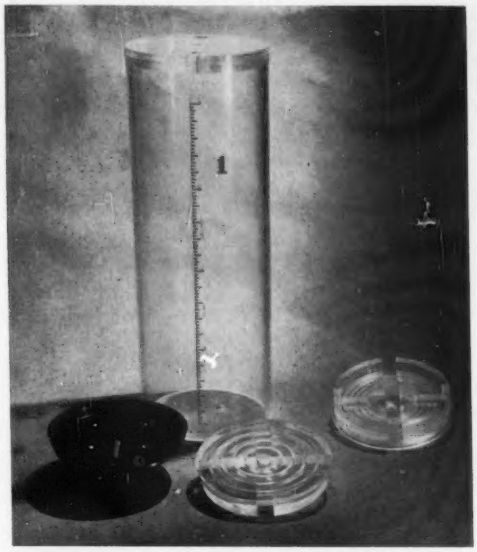


Fig. 4 Component parts of a laboratory silo. The plate in the background is placed above the sample. The other plate rests on the piston and contacts the bottom of the sample. This piston is provided with a synthetic rubber packing cup and a juice drainage system. The vertical scale is graduated in cubic feet to facilitate density determination

### Controlling the Variables

The design of the silo equipment is such that three variables can be studied either simultaneously or independently — light, temperature and pressure. Other variables, such as moisture, preservatives, or crop condition, can be predetermined and incorporated in the experiment.

One of the three temperature controlled cabinets housing nine laboratory silos is shown in Fig. 1. These cabinets are identical except for the air pressure controls in the master unit. Air pressure to the other units is supplied from the master unit through flexible hose lines.

On the right of the air circulating duct is the box containing the main switch, switches for main and auxiliary heaters, interior lights, and a switch that will control timing motors for recording juice flow. Below the switches is a box containing the ballast, starters, and pilot light for the interior fluorescent lights. On the left side of the duct is the box containing the relay switch, the damper motor transformer, and the four pilot lights.

The interior of the cabinet is shown in Fig. 2. Plexiglass panels have been removed from the upper part, exposing the silos. An insulated panel has been removed to expose the shelf for the large gas collection bottles and the $NO_2$ indicator bottles. At the top can be seen the Lucite silos (5½ in. inside diameter) that hold 5 to 6 lb of green material. Through the Lucite can be seen the silage pressure piston pushed upward by a piston rod from an air cylinder below. Juice collection bottles, connected by tubing to the pistons above, are located between the air cylnders.

A schematic of one silo within a unit is shown with its auxiliary equipment in Fig. 3. The silo is centered on a pin and is pushed against the upper frame channel by the pressure acting on the enclosed sample. The vent and gas collection plate carries to the gas manifold air displaced by the piston and gas generated in the silage. The silage pressure piston is so designed that juice and gas from the

lower side of the sample is directed to the juice collection bottle, where the juice accumulates and the gas passes on into the gas manifold. This gas, along with gas from the top of the silo, passes through the $NO_2$ detector and into the large gas collection bottle. The silage pressure piston uses a synthetic rubber packing cup to provide a seal for gas and juice at the silo walls. This piston is easily removed from the piston rod when placing the silo in or removing it from the unit.

Compressed air from the air manifold enters the air cylinder through the inlet valve, forcing the piston rod upward and putting pressure on the sample. Air is released to the atmosphere by another valve when silos are removed for weighing. A syphon controls the vacuum in the upper part of the gas collection bottle. The syphon adjustment tank controls the difference in elevation between the liquid level in the manifold and the lower end of the outlet tube, thus determining the amount of vacuum in the bottle.

### Silo Components

The component parts of the silo are shown in Fig. 4. Two ports are provided at the top for gas connections. Normally only one is used, but provisions have been made for circulating gas of known composition through the space above the sample and exposing to it a large proportion of the upper surface of the sample. The plastic plate in the background facilitates the gas collection and/or exposure of the top of the sample. The other plastic plate rides on top of the piston (left foreground) and facilitates collection of juice and gas at the bottom of the sample.

The important parts of the heating system are shown in Fig. 5. The silage temperature is controlled by controlling the ambient air temperature. The thermostats operate on a 2 F temperature differential. Silage temperatures recorded by thermocouples show a change of less than one degree. The circulating fan operates continuously, and heaters cannot operate unless the fan is in operation. Plexiglass panels provide a means of taking data without interfering with the heating system. Each of the three units have independent temperature control so that three different temperatures can be maintained simultaneously, to permit study of the effect of temperature on fermentation.

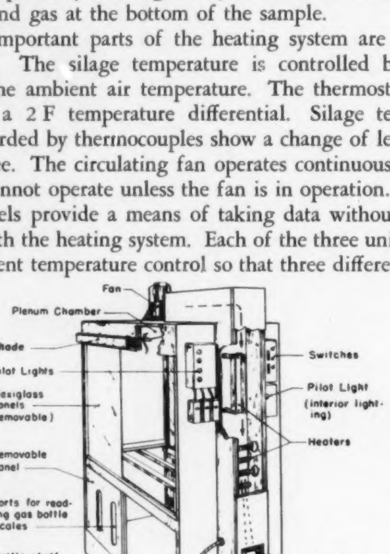



Fig. 5 A fan takes air from the upper plenum, passes it over thermostatically controlled heaters and discharges it into the lower plenum chamber. The heated air passing through peripheral slots sweeps the interior walls of the cabinet on its way to the upper plenum chamber

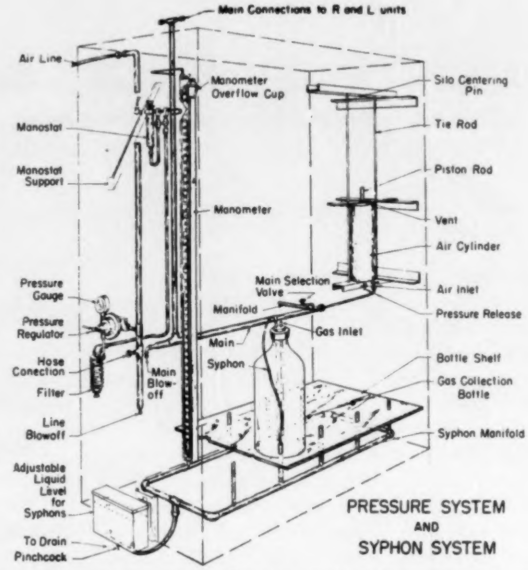



Fig. 6 The pressure on the silage is provided by compressed air actuating a piston rod. A small tank at the end of the unit controls the liquid level for the gas collection

A simplified diagram of the pressure system used in the master unit together with the syphon system is shown in Fig. 6.

One of the three mains is shown with the necessary controls and accessories. The air from the compressor enters a vertical standpipe provided with a blowoff valve at the bottom and a convenient hose connection near the lower end. Air is taken from this standpipe to the pressure regulator, where the pressure is reduced to a few psi above the pressure to be maintained in the main. The low pressure air is passed through a filter on its way to the main. Flow of air into the main is controlled by a needle valve. A Manostat on the low pressure side of the valve controls the pressure in the main. A tap from the main carries air through a manual valve to a short manifold that distributes the air to a group of three air cylinders. A manometer tapped into the main indicates the pressure being maintained. Pressure can be maintained with a 0.2 in. Hg differential.

The syphon system (lower level in Fig. 6) consists of a pipe loop provided with standpipes for the syphon tubes from the gas collection bottles. The loop is connected to a tank, fitted with a standpipe overflow, that can be adjusted to raise or lower the liquid level, thus controlling the amount of vacuum on the gas collection bottles.

Air mains, manifolds, and pressure selection valves are shown in Fig. 7. Each manifold connects a group of three air cylinders to any one of the three mains. Assuming the mains are under three different pressures two of the three valves at each location are closed and one is open to the selected pressure.

The air pressure controls and indicating manometers are shown on the back end of the master unit in Fig. 8. The open access door exposes the Manostats for adjustment. These instruments are located inside the unit because for accurate control of pressure they must be kept at constant temperature.

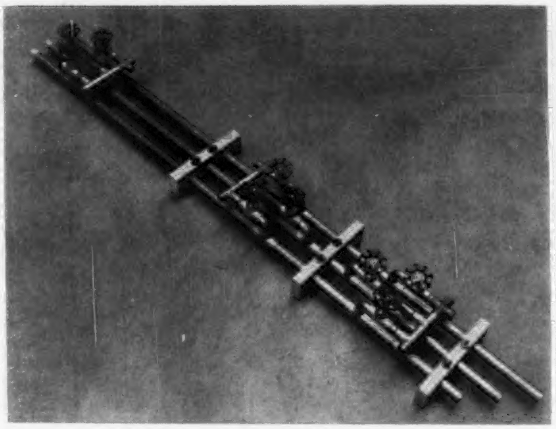


Fig. 7 All three air mains are connected through valves to three short manifolds, each of which supply air to three air cylinders. Pressure is selected for each manifold by opening the proper valve

## Evaluating Reliability of Silos

Evaluation tests were run to see how each of the nine silos performed. Cracked shelled corn fortified with potassium nitrate was used since it was felt that this would more nearly assure identical material in each silo. The potassium nitrate was added to produce $NO_2$ so that the method of detection and quantitative measurement of the gas could be tested also.

Table 1 shows the results of one such test of 6 days duration. A rather high variation between silos shows up in total gas and total $NO_2$ determinations. This appears to be due to techniques used in their measurement and some progress has been made in perfecting these techniques since this test was run.

## Other Features

Only 150 lb of green crop is needed to fill all 27 silos, making easier the selection of identical crop material for the tests. Provision is made for three replicates of each variable being studied.

Juice flow in the silage sample is similar to that in a large silo, i.e. gravity pulls it from lower density material on top through denser material which in these silos is next to the piston.

Light intensity on the silage samples can be varied. A large part of the surface of the silage samples can be exposed to air or to a gas of any known composition if desired. Any leak in the air lines or air cylinders does not expose the silage sample.

Fig. 8 Air pressure controls for the three units are on the back of the master unit. Pressure regulators, filters, manometers, and blowoff valves are on the outside of the cabinet. Manostats can be seen through the access door

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TABLE 1. EVALUATION TEST OF NINE LABORATORY SILOS OPERATING UNDER AIR TIGHT CONDITIONS WITH CRACKED SHELLED CORN. INITIAL MOISTURE CONTENT WAS 43.8 PERCENT (WET BASIS) AT A PRESSURE OF 12.7 ± 0.1 IN. Hg AND AMBIENT TEMPERATURE 91 DEG ± 1 DEG F. LENGTH OF RUN — 6 DAYS.

| Cyl. No. | Initial Net Wt. (gms) | Final Net Wt. (gms) | Total Wt. Loss (gms) | Volume Change (cu. ft.) | Total Juice (gms) | Total Gas (liters) | Total $NO_2$ mg of N | Acidity of Corn Removed (pH) | Final Vol. (cu. ft.) | Final MC By Toluene Dist. (% W.B.) | Final Density (lbs. per cu. ft.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3000 | 2840 | 160 | .0149 | 151.5 | 2.0 | 3.17 | 4.55 | 0.1029 | 41.79 | 60.7 |
| 2 | 3000 | 2836 | 164 | .0154 | 156.0 | 2.9 | 2.87 | 4.55 | 0.1016 | 42.78 | 61.6 |
| 3 | 3000 | 2842 | 158 | .0145 | 144.0 | 2.6 | 3.89 | 4.55 | 0.1015 | 41.63 | 61.7 |
| 4 | 3000 | 2839 | 161 | .0151 | 150.0 | 2.8 | 1.18 | 4.55 | 0.1010 | 41.72 | 61.8 |
| 5 | 3000 | 2836 | 164 | .0156 | 154.0 | 2.6 | 3.98 | 4.55 | 0.1014 | 41.45 | 61.6 |
| 6 | 3000 | 2842 | 158 | .0153 | 149.0 | 2.9 | 4.27 | 4.55 | 0.1015 | 42.68 | 61.6 |
| 7 | 3000 | 2847 | 153 | .0146 | 142.0 | 3.0 | 2.83 | 4.55 | 0.1025 | 42.04 | 61.2 |
| 8 | 3000 | 2850 | 150 | .0145 | 141.5 | 3.0 | 4.34 | 4.55 | 0.1020 | 42.60 | 61.6 |
| 9 | 3000 | 2845 | 155 | .0156 | 145.5 | 2.6 | 3.31 | 4.55 | 0.1009 | 41.80 | 62.0 |
| | Standard Error (5% level) | | ±2.3% | ±2.3% | ±2.7% | ±11% | ±22% | | | ±1% | ±1% |

# Economic Evaluation of Soil and Water Management Measures

Melville H. Cohee

***The author brings together in one "package" the essentials of economic evaluation of soil conservation***

SOIL and water conservation is recognized as one of the more important needs for the United States. If we are to continue to enjoy a high standard of living, we must protect our basic land resources and conserve and judiciously use our water supplies.

Successful farming and proper land use require wise use of capital and human resources. Principles of agricultural economics and farm management, as well as soil science, engineering, agronomy, biology, geology, forestry, plant genetics and others must be drawn upon and focused into a coordinated solution of the land-use and treatment problems for individual areas. Basic research in many of these fields has been and will continue to be an invaluable and necessary asset to the applied science of soil and water conservation.

A comprehensive, scientific soil and water conservation program has been in progress for at least a quarter century and is still expanding. It was well along in 1945 when an official organ of the U.S. Department of Agriculture first referred to it as a science and defined its guiding principles, as follows: "Soil conservation is one of the newest of all applied agricultural sciences. The basic guiding principle can be stated as follows: Effective prevention and control of soil erosion and adequate conservation of rainfall in a field, over a watershed, or on any other unit land, requires the use and treatment of all the various kinds of land comprising that area in accordance with the individual needs and adaptabilities of each different area having any important extent."*

In introducing his comprehensive book, "The Economics of Soil Conservation," Dr. Arthur C. Bunce provides some excellent summary statements that afford directional thinking on this subject. First: "Conservation is an objective of social planning, and should include within its basic purpose the concept of maximizing individual and social wealth over time; its primary, but not sole, concern is to direct the use of resources toward that end†." He also states: "Soil conservation is a physical or technological problem, as well as economic, and it is essential that the interrelationships between these two aspects be clearly seen. The physical specialist needs to understand the economic implications of physical changes just as the economist needs to understand the physical factors which underlie the problem. Those who formulate policies should base decisions upon both physical and economic factors if social action is to become progressively more effective and economic in nature."

### Physical changes and economic implications

One of the problems the soil conservationist faces in his evaluation of soil and water-management costs and benefits is the correct recognition of economic values. These values accrue both to private individuals and to society from many

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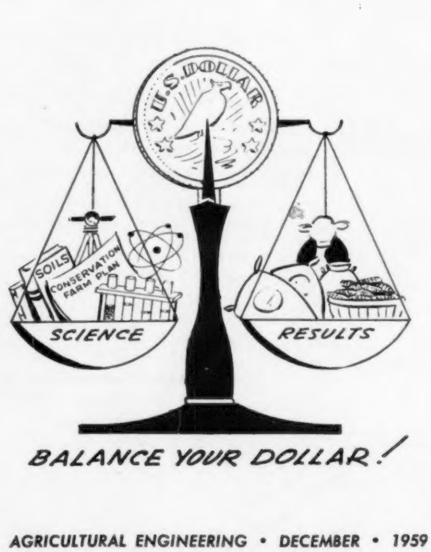
*Soil Conservation, USDA, Washington, D. C., Vol. X, No. 11; May 1945; page 238.

†Arthur C. Bunce, The Economics of Soil Conservation, Iowa State University Press, Ames, Iowa, 1950, page vii.

of the measures installed. Since social benefits are to be obtained, private land owners are assisted in many ways from public resources. These benefits may be both tangible and intangible. Irrespective of how costs may be distributed between the private landowner and the public, which may depend upon social philosophy, and other considerations prevailing at a given time, the soil conservationist should keep sight of the economic implications of physical changes—derivation of accruing benefits. He should avoid what Siegfried von Ciriacy-Wantrup terms "the creation ad hoc of some sort of 'cost free' land economics in order to make proposed actions appear economically desirable when they are not; although these actions may be of great social value from other aspects and may deserve consideration for that reason."‡

In economic evaluation of soil and water management practices, therefore, we must keep in mind many basic principles about the purpose of conservation. We should treat soil conservation as the applied agricultural science it is and employ well-founded evaluation methods. Selection of alternate practices or combinations of practices to meet a given problem is truly a coordinated physical and economic matter. If this is properly done, soil and water management will result. Dr. Charles E. Kellogg gives this responsibility real direction with the proposition ". . . that there are few conflicts between those systems of management that give the greatest economic return and those that insure the continual improvement and conservation of the soils. Conceivably we may be able some day day to draw up a true balance sheet for a soil. What we seek is not some kind of mythical balance between farmers and the soils they cultivate, but a cultural balance in which we use with understanding and precision all the tools of modern science, engineering and economics."**

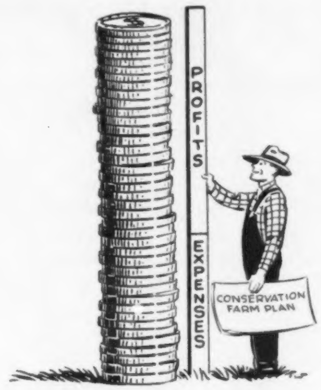
### Principles of Evaluation

The nature and purpose of a specific soil and water conservation measure determines the method to employ in making an economic evaluation of its worth. One over-all purpose is that the measure satisfies man's wants. Those wants may be only from the private individual's point of view or they may be partly that plus some broader interest in social needs and benefits. In any event, development of a conservation measure always involves the production, conservation, and use of goods and services.

Economic goods and services encompass all objects and services that are limited in supply and have the power of satisfying wants. The basic problem in economic evaluation is involved in properly comparing the value of the goods and services produced or conserved, with the costs incurred, and, in so doing, to take full account of all effects from the measure.

### Dollars as Common Denominator for Costs and Benefits

To make meaningful the comparisons of costs and benefits of a conservation measure, monetary estimates constitute about the only available means. Dollar terms provide a yardstick for measuring the relative values of different types of effects at the time of their occurrence. Prices provide a system of weights that may be used to convert various physical




*HOW DO YOUR DOLLARS MEASURE UP?*

effects to a common dollar basis. It is recognized that the values attached to goods and services by the market may not always reflect all values, especially those of a public viewpoint. This seems rather obvious when it is pointed out that existence of such factors as subsidies, tariffs, price supports and surplus commodities must place certain limitations upon the market as a measure of all values. Despite this circumstance there appears to be no other better way to appraise values of conservation measures than to start with market prices for the economic analysis.

In addition, for many conservation measures there will be effects, both in benefits and costs, which fall into the category of intangibles and defy monetary measurement. These intangible effects and costs do have values and usually can be described in meaningful terms. An example is a small pond located near the farmstead; it not only provides water for livestock but also is stocked with fish and enhances the landscape beauty as viewed from the farmhouse. The livestock water supply can be evaluated in monetary terms but the fish and landscape view must find their expression of evaluation primarily in descriptive, narrative terms.

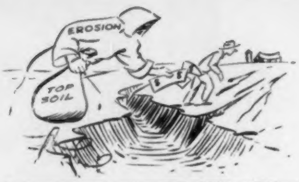
This paper, however, is concerned principally with tangible values of conservation measures. The value of benefits produced from the measure is their exchange value, as measured by expected market price at time of accrual.

### Independent and Interdependent Measures

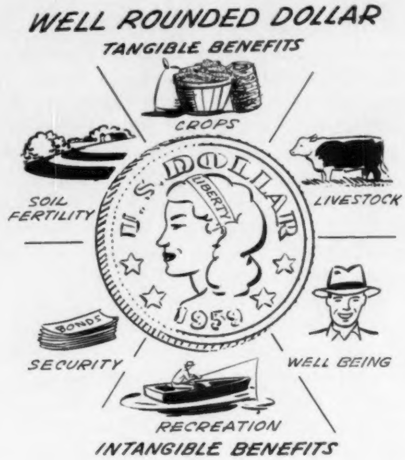
Generally soil and water conservation measures may be grouped into two broad categories. First, are those measures whose purpose is accomplished by their installation as an independent measure. For example, a sod waterway which is a vegetated channel capable of conducting runoff water at safe velocities to a stable outlet. If no mechanical measures, such as a terrace system, are emptying into the sod waterway, their purpose and value is in preventing erosion and possible formation of a gully on the site. Reduction or elimination of damage from runoff water coming from the drainage area lying above its location is assured thereby. Similarly, a dam with a fixed drawdown tube and an emergency spillway may be installed for the purpose of protecting land from inundation. Benefits attributable to the dam are mostly offsite and downstream from the dam. With both of these examples the benefits are direct; no other associated practices are needed.

‡Siegfried von Ciriacy-Wantrup, Economic Aspects of Land Conservation, Journal of Farm Economics, May 1938, page 472.

**USDA Yearbook of Agriculture, 1957, page 11.








Benefits from other soil and water conservation measures are realized only through interdependency with another conservation measure. In the cornbelt, for instance, a gully-stabilizing structure is interdependent with land-treatment measures for areas draining into the gully. Gullies are eating through lands that are suitable for continued cropping with up to 40 percent row crop, 20 percent small grain and 40 percent meadow, providing a gradient terrace system is installed. This structure assures a stabilized watercourse for the terrace outlets. Without the structure, terraces would add to the problem in the drainage area above the present gully, and in a few years the land would be suitable only as pasture or woodland, if even these. Continued cropping on unprotected land in many gully erosion areas has resulted in a serious fingering system of gullies until the fields have been abandoned.

The value of such a gully stabilizing structure or series of structures is measured by the difference in net returns from a protected area and what it would be after a given period without protection. Soil saved by stabilizing the gully may be only a small part of the total benefits since land depreciation is prevented on the entire drainage area. Not only is depreciation prevented, but land use is enhanced when gradient terraces are installed. Terraces can be installed once the gully is stabilized and ready to receive runoff from the terraces.

Furthermore, if non-recoverable land damage, or gully erosion, is prevented, there is an added benefit to society that is not reflected in the market value of benefits to the private landowner. This may be determined by comparison of the rates of interest reflected over time for social productivity of capital with that for discount rates on private investments. Annual returns to the land, after deducting real estate taxes, capitalized at the earning rate for social productivity of capital, less the capitalized value of these annual returns at private investment rates, represents society's benefits from gully-stabilizing dams.

### Time Discounts

Research studies and observations provide factual data that benefits from soil and water conservation measures come over future years. Some measures give net benefits in excess of total costs in two or three years; it is the exception for the first year. Other practices take up to ten years to pay for their costs.

Often the net income from a farm is decreased the first or second year during wide-scale installation of conservation measures. Such decreases usually are more than offset by higher future net incomes even when discounted to present worth.

Resulting benefits from conservation measures should always be considered in relation to time. The economist speaks of this as time preference. A farmer may not make specific calculations in economic terms, but he reasons whether he can maximize profits in the long run. This means that future benefits of an installed measure must be discounted to present values. The farmer considers other things than just dollars—he may place a value on not going into debt or on having more leisure time because of less intensive farming operations. Such intangible values cannot be reduced to dollars, but they do influence decisions.

The value of today's dollar ten years from now is slightly less than fifty-six cents if figured at 6 percent compound interest. Suppose a person has a negotiable paper promising him $100 ten years hence, but he wants money now. At the 6 percent consideration, he learns that the paper may be liquidated now for only $55.84. This is true with a soil conservation measure that yields a future return; its present worth is at a discounted value. Any reasonable person discounts benefits he has to wait for.

Some landowners are not financially able to wait a long time to realize net benefits from soil and water conservation measures. Those with limited capital are least able to wait. They should start with conservation practices that give benefits in excess of costs as quickly as possible.

With such increased income they may move forward with the long-term investment measures. For example, improved crop rotation may require added lime and commercial fertilizer applications beyond what a farmer is now using. These investments begin to bring appreciable added returns the first year and usually are paying sizable net returns before the second cycle is completed.

Landowners with unlimited capital may invest in soil conservation measures having net profits coming over a long period. This means that such an individual does not need to discount the discomfort of waiting as much as one who is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unable to withdraw his limited capital from other needs. Time preference rates are affected by the level of income of the landowners and operators who invest in soil and water conservation measures. Generally, time-preference rates increase as income levels decrease, and conservation is retarded.

**Amortization of Initial Cost**

Initial costs for soil and water management conservation measures should be prorated or amortized over the benefit-producing life of the practice or other determined years in order to compare annual benefits with costs. If the landowner chooses some definite amortization period short of the life of the measure, then the initial cost must be spread over such shorter period.

If properly operated and maintained, some practices will last 30 to 50 years, or indefinitely. This is true with terraces, ponds, structures, tile and open drainage, waterways and the like. It is very reasonable to explain their costs in terms of an average annual figure that spreads over their life of expected benefits. Even though a measure, when properly installed, might be thought to be permanent for all years to follow, it may be proper to assume some reasonable period of years for amortization purposes that is within the span of planning expectancy which the farmer may customarily acknowledge. Some references cite 20 years as reasonable maximum, but it can vary according to physical circumstances and the individual farmer.

In financing terms amortization is said to be the extinguishing of a financial obligation in equal installments. The amortization factor is the amount of the installment required in periodic payments to retire a debt of $1.00 in a given length of time. For example, if a farmer borrows $1000 at six percent for three years, he must pay $374.11 per year on a note as follows:

| Year | Payment | Interest charge | Payment on principal | Unpaid balance |
|---|---|---|---|---|
| 0 | —— | —— | —— | $1,000.00 |
| 1 | $ 374.11 | $ 60.00 | $ 314.11 | 685.89 |
| 2 | 374.11 | 41.15 | 332.96 | 352.93 |
| 3 | 374.11 | 21.18 | 352.93 | |
| | $1,122.33 | $122.33 | $1,000.00 | |

Added points can be developed from the above example. This farmer, who borrowed at 6 percent interest, actually paid $122.33 for interest. It was over a period of three years; consequently, *on the average,* he paid $40.80 per year for interest. If only considered on a 3-year basis, this farmer needed $374.11 in benefits to repay the principal and to pay interest on the loan.

It can be assumed that in the above example the farmer was not especially limited in capital supply. The conservation measure installed may have a life expectancy of 15 years or more. Assume, therefore, that another farmer desires to amortize such an investment over 15 years. His annual payment would be $103, figured with 6 percent annuity tables. The annual payments for 15 years add to a total of $1544. Thus the total interest cost is $544, or roughly equal to 50 percent of the principal. It costs this farmer $422 more to liquidate the investment in 15 years than the first one who amortized in 3 years. It is a case which may illustrate the point that one farmer could not pay more than $103 in any one of 15 years while the other could pay $374 for each of 3 years.

If benefits on an average annual basis provide a ratio to costs of $1.60 to $1.00, then they must equal 1.6 times $103, or $165, on the average per year. This is an average annual net benefit of $62. If this net benefit amount were deposited each year for 15 years and each year discounted to present worth, the sum total value would be $602. These figures do not include operation and maintenance costs.

The farmer, who at first might hesitate to obligate himself for a $1,000 investment in one or a combination of soil and water management conservation measures, may view it with more favor when he considers average annual costs against average annual benefits. In fact, as pointed out earlier, if he is in a financial and time-preference position that he need not discount the future benefits so heavily—say, at 4 percent rather than 6 percent—the present worth of net benefits he may gain could equal almost $700. It is to be remembered that these are net benefits and land value assets over and above payment for costs of the conservation measures installed. The only businesslike way to consider conservation costs is on an amortized, average annual basis in order that they may be compared with annual benefits.

## EXAMPLES OF EVALUATIONS

**Contouring**

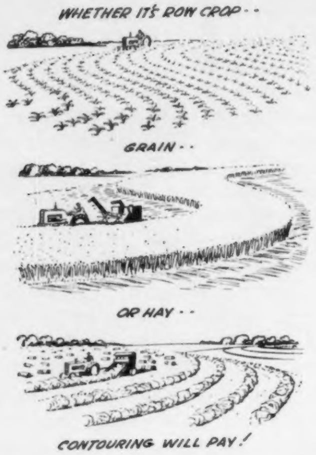
One of the cheapest of all mechanical soil and water conservation measures is contouring. It applies principally to row crops and small grain crops.

To illustrate the value of this practice, a 36-acre field of Oconee silt loam and Patton silt loam, having not over a 2 to 6 percent slope and only slight erosion, will be used from a south central Illinois farm.†† For prevention of erosion and maintenance or improvement of soil fertility, at a moderately high level of soil management, and without contouring, a 1-1-2 (corn, barley, two years of meadow) rotation should be followed. The average yearly corn yield per acre is 65 bu; for barley it is 26 bu, and the hay yields average 2.5 tons. If land is operated on the contour, however, the corn yields increase to 70 bu per acre, the barley yields go up to 30 bu and the hay yields average 2.8 tons per acre.

This means 5 bu of added corn per year for each of the 9 acres in the rotation, or 45 bu. At the projected long-term price of $1.42 per bushel, this extra corn has a gross value

††Illinois Economics and Farm Management Handbook, Soil Conservation Service, USDA, Champaign, Ill., June 1957, page 54.

## . . . Soil and Water Management




of $64. Similarly, the added 36 bu of barley at $1.16 per bushel has a gross value of $42. Hay at $20 per ton gives added gross value of $108 from the 18 acres of meadow. The total increased gross value is $214 for the 36 acres of contoured land, or a per acre average annual increase in gross value of crops produced amounting to about $6.00 per acre. Increased costs of production varying with yields should be subtracted, and it can be figured roughly at 10 percent of the added gross value. Any added costs of production due to farming on the contour would be small. With these subtractions accounted for, the net benefits realized from the contouring practice on this field would still be in excess of $5.00 per acre even with continuation of the same crop rotation as was followed without the contouring practice applied.

This 1-1-2 crop rotation on this 36 acres meets essential criteria for soil conservation without contouring. Soil conservation may still prevail with a 2-1-2 (two years row crop, one year small grain, two years of meadow) rotation if field operations are performed on the contour. The farmer may select rotations to balance crop supplies with livestock needs, if supplementary conservation practices are applied as needed. In this instance there would be more corn and less hay with the 2-1-2 rotation than the 1-1-2 rotation. The average annual net benefits per acre, however, as measured in terms of gross value of increased crop production, is not much different from the $5.00 figure given above.

### Terracing

This 36-acre field may be terraced. Water from the terrace outlets can go into a permanent pasture area without concern about creating any erosion hazard. If the field is terraced, the rotation may be increased in intensity to a 2-1-1 (two years corn, one year grain and one year meadow). Yields will increase to 72 bu per acre for first year corn and 69 bu for second year corn, 32 bu for barley, and 2.6 tons of hay.

Similar type of evaluations to those presented above give a result of $6.50 per acre of average annual net benefits per acre from the terrace practice, *if* the 1-1-2 crop rotation is continued, or about $1.50 per acre better than for the contouring practice. This increase, however, is *before* associated costs for terrace construction and maintenance are subtracted. If the rotation on this terraced field is changed to the 2-1-1 type, the net average annual gross value of benefits is $14 per acre *before* associated costs for terrace construction and maintenance are subtracted.

Associated costs per acre for the terrace system are determined as follows:

Initial installation cost, $14 per acre

Amortized cost for 20-year period of farmer's future use, at 6 percent interest rate, $1.22 per acre ($14 × 0.08718)

Annual maintenance costs, 60¢ per acre

Total average annual terrace cost per acre, $1.82.

Based on considerable cost accounting data in Minnesota, Rorholm, Downing and Engene, agricultural economists, have proven that without wide differences in acreage of different crops in the crop rotation, average per acre costs for production and harvesting are not appreciably changed‡‡. Preliminary checks on the 1-1-2 and 2-1-2 and 2-1-1 rotations used in this case, indicate that differences in their average costs per acre are insignificant. Increases in gross production values, facilitated by the soil conservation practice through added yield per acre and more intensive crop rotations, provide valid data for measuring economic effectiveness, in this case, of contouring and terraces.

A summary of the 36-acre field case would be as follows:

*(a)* Contouring and no change in crop rotation—over $5.00 per acre benefits. With a change in crop rotation from 1-1-2 to 2-1-2, not much change from the $5.00 per acre benefit figure.

*(b)* Terraces and no change in crop rotation—$6.50 per acre net benefits minus associated average annual terrace costs of $1.82; net benefits, $4.68 per acre.

*(c)* Terraces and their facilitated change in crop rotation from 1-1-2 to 2-1-1, gives an increase of $14 per acre net benefits minus associated average annual terrace costs of $1.82; leaves a net benefit just over $12 per acre.

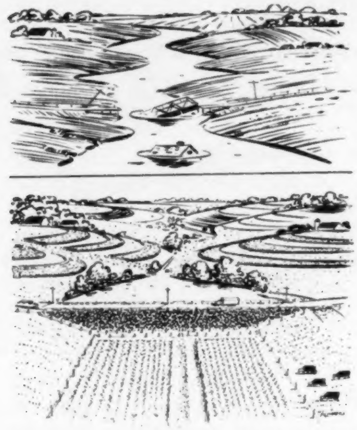
*(d)* On this field terraces offer no advantage over contouring unless a more intensive crop rotation change is made; in fact, an economic disadvantage results as measured by the value of crops produced minus associated terrace costs.

### Floodwater Retarding Structures

In flood-prevention economic evaluations the first step is to appraise the damages to be alleviated by protective measures. Usually such floodwater damages are downstream from the structure sites. They may be, in broad classification, one or more of the following types of damages: Inundation of crops and pasture; damages to fences, stored crops, farm roads and bridges, field equipment, etc.; destructive effects to public roads and bridges, railroads and public utilities; or damages from infertile overwash, swamping, scour, valley trenching; or damages to urban properties. In comparing costs of preventive measures with reference to benefits, each

‡‡Corn, Oats and Hay Costs are Nearly Equal, Minnesota Farm Business Notes, University Farm, St. Paul, No. 337, May 30, 1952, and Preliminary Summary Costs and Returns for Crop Production, Southern Minnesota Detailed Accounting Farms, Averages for 1951, 1952, and 1953, University Farm, St. Paul, Minn.

## . . . Soil and Water Management




must be evaluated monetarily and expressed in terms of average annual equivalents.

Damage appraisal is directed toward establishing the relationship between floodwater damages and flood sizes for significant variations in flood-plain and hydrologic conditions. There are different methods that may be used to determine these relationships but this basic premise applies to all methods. Generally the two most commonly used are termed the "frequency method" and the "historical series method." In employment of either method, an appraisal is made of damages that have taken place and which may be repeated in the future without flood prevention measures.

The severity of floodwater damages is not the same with each flood. The time of the year when a flood occurs makes a big difference. Furthermore, how much area the water covers and its depth and duration are significant added factors, and frequency of flooding is extremely important.

There are five basic relationships of flood characteristics that figure prominently in determining average annual floodwater damages: flood stage versus peak discharge; flood stage versus area flooded; peak discharge versus frequency of occurrence; area flooded versus damage, and flood damage versus frequency of occurrence.

Basic economic evaluations are made at specific locations in the flood plain. Although damages occur at certain site locations, all floods may not have a stage causing their waters to reach the same points of the flood plain. Consequently, the frequency a certain amount of damage takes place during a given evaluation period, for example in 50 years, must be determined in order to evaluate the damages on an average annual basis. Hydrologic data and economic data must be fitted together as characteristics of the floods dictate.

Economic evaluation of a floodwater-retarding structure is illustrated as follows: There are 5200 acres in a small subwatershed evaluation unit. Some 700 acres of bottomland are damaged by floodwaters from the 4500 acres of upland area. Damaging floods are presently occurring at least every other year and sometimes as often as three times in a single year. Topography of the 700 acres is such that most of it is flooded whenever waters overflow the stream channel banks.

Installation of a floodwater structure that will control drainage from 80 percent of the upland area will provide protection to the lower parts of the 700 acres to the extent that a flood of once in five years will be kept within stream channel banks. All smaller size floods are included. For the upper part of the 700 acres, or that which is nearest the structure, out-of-bank flow from floods will occur less frequently than once in 15 years.

The following tabulation of damages and benefits, with and without the flood-water-retarding structure, clearly indicates that the average annual benefits to be realized are $6200. These benefits are all realized from reduction of damages; no changed land use benefits are included.

| | Average Annual Dollar Damages and Benefits | | |
|---|---|---|---|
| Types of damage and benefits | Present damages | Remaining damages with structure | Benefits |
| Crops and pasture | $6400 | $1300 | $5100 |
| Other agricultural | 600 | 200 | 400 |
| Non-agricultural | 1000 | 300 | 700 |
| Total | $8000 | $1800 | $6200 |

The average annual total costs for installation, plus operations and maintenance of the structure are $4000. This is based upon a 50-year evaluation period and use of a 2½ percent interest rate amortization factor for initial installation costs, including easements for structure site and reservoir area, plus an annual charge for operations and maintenance. Actual initial costs for this works of improvement are approximately $100,000.

The relationship of benefits to costs is found by a comparison of average annual benefits to average annual costs. These are respectively $6200 and $4000. The benefit-cost ratio, therefore, is 1.55:1; that is $1.55 of benefits accruing for each $1.00 of costs.

## . . . Harvesting Dwarf Corn

*(Continued from page 735)*

but on flat, uncultivated ground, performance may be acceptable. Topping does not appear to improve combining of dwarfs, at least at late maturity.

**References**


1 Leng, E. R. Genetic production of short-stalked hybrids. Proceedings of Twelfth Annual Hybrid Corn Industry—Research Conference, p. 80-86, American Seed Trade Association, Chicago, December 4 and 5, 1957.

2 Illinois Experiment Station, unpublished data.

3 What's the Score on Dwarf Hybrids. *Farm Journal*, p. 51, December 1958.


## TRANSACTIONS of the ASAE

January 15 is the final deadline for ordering copies of the special Soil and Water edition of the 1960 TRANSACTIONS of the ASAE which will contain 100 pages, devoted exclusively to Soil and Water subjects. Copies are available at $4.00 each ($3.00 to ASAE members). Publication of the Transactions permits ASAE to nearly double the number of papers being published in a recognized indexed publication. The second edition, containing at least 144 pages of technical articles, will be published later in the year. Copies of General edition sell for $6.00 each ($3.25 to ASAE members). Combined price for both editions is $8.00 ($5.50 to ASAE members).

# Hop Harvesting Machines

**Max Hupfauer**
*Member ASAE*

***Performance of hop-harvesting equipment in the Federal Republic of West Germany***

THE use of hop-harvesting machines has been common in the United States for many years. Therefore, it is questionable whether the experiences of European countries, which have used mechanical-harvesting methods but a few years, will produce much new information for American hop producers. However, exchange of observations may be of mutual interest in spite of the existing differences in climate, economic conditions and processing methods. This is the reason for presenting in this article the results of investigations of hop-harvesting machines in the Federal Republic of West Germany. The figures given represent observations during the harvests of 1957 and 1958. They are gathered mostly in the Bavarian County of Hallertau, which is the largest German hop-growing area; this area covers about 5300 ha (approximately 13,100 acres).

The amount of labor required, the quality of the product harvested, the amount of spoilage, the cost of mechanical harvesting with different types of machines investigated are reported here and are based upon multiple measurings. The results are coordinated in the accompanying tables and charts. In each comparison the resulting average values are shown for one specific condition.

Fig. 1 and Table 1 provide a comparison of average output and size of crews during the harvests of 1957 and 1958. Three different types of machines were used, as follows:

"Allaeys" imported from Belgium and built by Allaeys, Constructiewerk, Poperinge, Steenweg op Proven 58

"Bruff (five different models), English design, built in Germany by Scheibenbogen & Co., K G., Landshut, (Bavaria) Industriegelaende, Ottostr. 28

"Rotobank," English design, built in Germany by F. J. Sommer, Maschinenfabrik Landshut (Bavaria)

The definition of the performance of each machine is based upon the weighed output of green hops per hour. The measurement was chosen as a scale because it provides a more accurate picture of performance than the comparison of vines processed per hour. The explanation is to be found in the fact that the amount and size of hop clusters per in-

Paper prepared expressly for AGRICULTURAL ENGINEERING.

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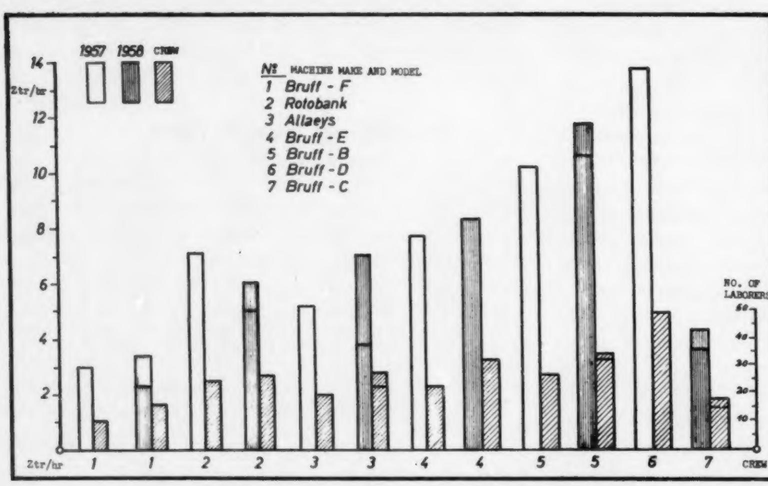



Fig. 1 Comparison of different machines in regard to output and size of crew

TABLE 1. COMPARISON OF AVERAGE OUTPUT AND CREW SIZE OF DIFFERENT HOP-HARVESTING MACHINES

| Machine number: Make and model: | 1 Bruff F | 2 Rotobank | 3 Allaeys | 4 Bruff E | 5 Bruff B | 6 Bruff D | 7 Bruff C |
|---|---|---|---|---|---|---|---|
| Average ztr/hr* 1957 | 3 | 7.2 | 5.2 | 7.8 | 10.2 | 13.8 | — |
| Average ztr/hr* 1958 | 3.4 | 6 | 7.1 | 8.2 | 11.8 | — | 4.3 |
| Average kg/hr** 1957 | 150 | 360 | 260 | 390 | 510 | 690 | — |
| Average kg/hr 1958 | 170 | 300 | 355 | 410 | 590 | — | 215 |
| Vines (1.5 kg cluster content)/hr*** 1957 | 100 | 240 | 170 | 260 | 340 | 460 | — |
| Vines (1.5 kg cluster content)/hr | 113 | 200 | 237 | 270 | 383 | — | 143 |
| Manpower—Total 1957 | 10 | 25 | 20 | 23 | 27 | 50 | — |
| Manpower—Total 1957 | 16 | 27 | 27 | 33 | 34 | — | 19 |

Legend: *ztr per hr=110 lb per hr **kg per hr=2.2 lb per hr ***vines (of 3.3 lb cluster content) per hr

dividual vine varies distinctly. In order that an approximate comparison can be made of figures found in the literature and those presented by the manufacturers of the machines, their performance also has been computed and is shown in the tables in the frequently used terms of vines per hour, assuming an average of 1.5 kg (3.3 lb) green hops per vine.

In regard to machines Nos. 1 to 5, it was possible to use values obtained during two seasons. The performance of machine Nos. 6 and 7 could only be observed during one season. Some columns of the diagrams are horizontally divided by a line, which is intended to mean that the values based upon part-time operation differ from those computed by dividing the weight of the total harvest by the total operating hours. Incidental impairments of performance during measurement due to unskilled personnel, hail-damaged hops, transportation difficulties and similar causes justify the upward adjustment of values according to the final "total" values.

In 1958, in almost all cases, an increase in crew strength as well as a partially decreased output can be seen in comparison to 1957. This fact indicates the attempt and desire to improve the quality of the harvested hops.

Referring to Fig. 2 and Table 2, the German expression "Bonitierungswert," awkwardly translated "Bonitation value," defines the relative percentile of perfect, slightly damaged and crushed clusters, as well as the presence of stem and foilage portions. These weight percent values have been obtained by sorting and weighing samples of 250 grams (0.55 lb) each as to their content of sound, damaged and crushed clusters, as well as stem and leaf portions. The comparison shows that in spite of the attempts to improve the quality during the harvest of 1958, the proportional share of damaged clusters increased rather badly. This observation, however, did not surprise the experts since in 1958 the hop clusters were distinctly more sensitive than in 1957; the clusters in general were larger, less compact and much more brittle due to the drought during the harvesting period of 1958.

Fig. 3 and Table 3 show the partially greater spoilage of the 1958 harvest which is expressed in weight percent. The explanation of this occurence is to be found in the same causes as mentioned above.

In Fig. 4 and Table 4, when defining the cost, the measure used was the "metzen". This is the conventional measuring container of this area used to define the performance of hand pickers. The "metzen" represents a volume of 60 liters (approximately 15.85 gal) with an equivalent average weight of 5.4 kg (11.9 lb) of green hops. The cost of mechanical harvesting has been computed on the basis of three conditions: 20, 10 and 0 percent depreciation of the machines per year; they are compared with the cost of manual harvesting. The manual harvesting costs used for comparison have been taken from a previous publication. However, one may state that the actual costs during the last harvesting season rose some. The demand of the laborers in regard to wages and boarding increased slightly, the clusters

Fig. 2 Comparison of bonitation results in weight percent for 1957-1958

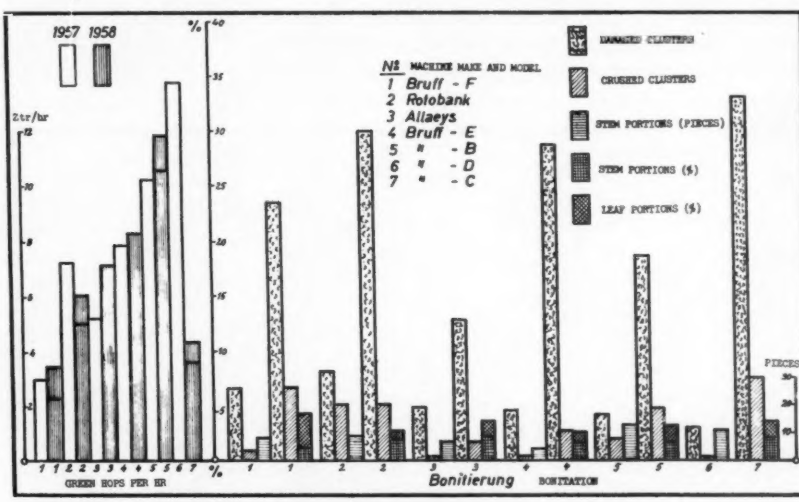



TABLE 2. COMPARISON OF THE "BONITATION RESULTS" IN WEIGHT PERCENT FOR 1957 AND 1958

| Machine number: Make and model: | 1 Bruff F | 2 Rotobank | 3 Allaeys | 4 Bruff E | 5 Bruff B | 6 Bruff D | 7 Bruff C |
|---|---|---|---|---|---|---|---|
| Perfect clusters, 1957 | 92.7 | 87 | 95.2 | 94.7 | 94 | 97.1 | — |
| 1958 | 55.35 | 62.04 | 81.68 | 65.97 | 73.73 | — | 55.78 |
| Damaged clusters, 1957 | 6.5 | 8 | 4.5 | 5 | 4 | 2.6 | — |
| 1958 | 23.4 | 30 | 12.86 | 28.64 | 18.7 | — | 33.2 |
| Crushed clusters, 1957 | 0.8 | 5 | 0.3 | 0.3 | 2 | 0.3 | — |
| 1958 | 6.96 | 5.14 | 1.77 | 2.73 | 4.72 | — | 7.5 |
| Stem Portions (pieces), 1957 | 8 | 9 | 5 | 4 | 9 | 8 | — |
| 1958 | 1.05 | 1.89 | 2.26 | 1.58 | 1.61 | — | 2.16 |
| Leaf Portions, 1958 | 3.24 | 0.88 | 1.43 | 1.08 | 1.54 | — | 1.36 |

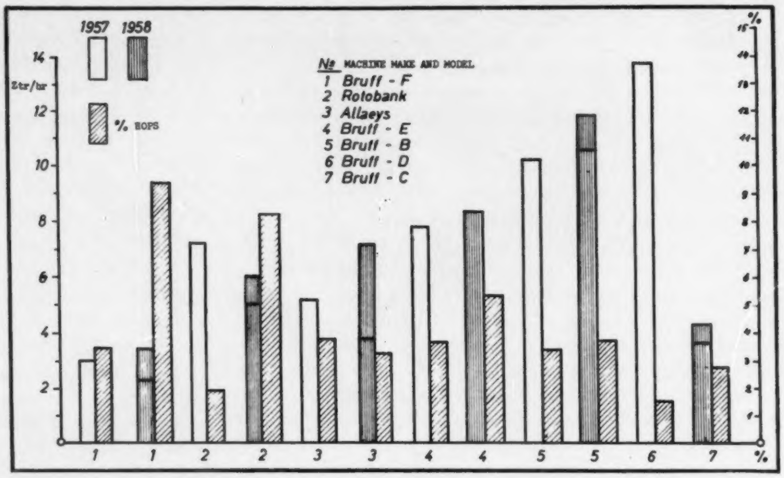



Fig. 3 Comparison of loss of hops per Kg (2.2 lbs) waste weight percent for 1957-1958

TABLE 3. COMPARISON OF SPOILAGE, 1957-1958 (LOSS OF HOPS IN WEIGHT PERCENT PER KILOGRAM (2.2 LB) OF WASTE

| Machine number:<br>Make and model: | 1<br>Bruff F | 2<br>Rotobank | 3<br>Allaeys | 4<br>Bruff E | 5<br>Bruff B | 6<br>Bruff D | 7<br>Bruff C |
|---|---|---|---|---|---|---|---|
| Waste percentile, 1957 | 3.46 | 1.92 | 3.71 | 3.70 | 3.39 | 1.54 | — |
| Waste percentile, 1958 | 9.37 | 8.24 | 3.31 | 4.39 | 3.76 | — | 2.82 |

were larger and the weather favorable for harvesting, resulting altogether in somewhat higher costs of manual picking per unit weight.

In regard to the stated costs per metzen, when harvesting mechanically, it is emphasized to consider that these values vary over a rather wide range, depending upon the condition of the hops and the more or less proper organization of the work. The values presented here are based upon information about the performance of the machines as received from their owners.

Finally a set of rules is presented which is valid for all machines. The rules are considered an essential result of

*(Continued on page 750)*

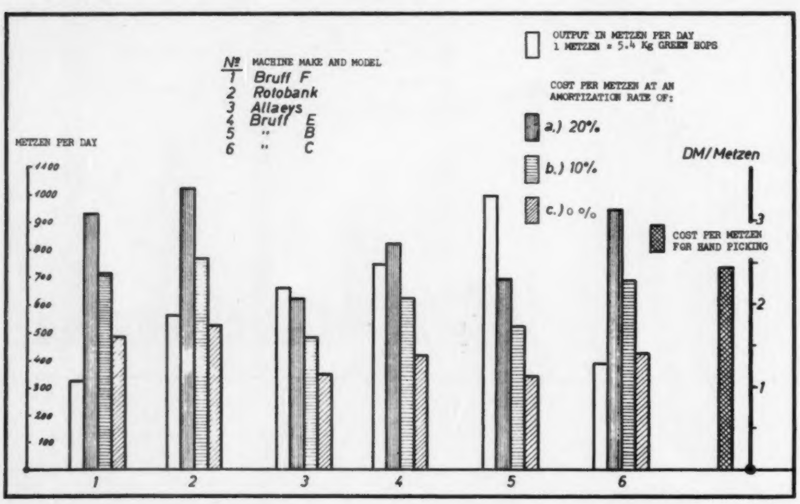



Fig. 4 Cost per metzen at various rates of amortization

TABLE 4. COST PER METZEN AT VARYING DEPRECIATION OF MACHINES

| Machine number:<br>Make and model: | 1<br>Bruff F | 2<br>Rotobank 3/75 | 3<br>Allaeys | 4<br>Bruff E | 5<br>Bruff B | 6<br>Bruff C |
|---|---|---|---|---|---|---|
| Output of metzen per day | 320 | 560 | 663 | 748 | 1004 | 401 |
| Cost per metzen at depreciation rates of: | | | | | | |
| 20 percent | 3.08 DM | 3.42 DM | 2.08 DM | 2.75 DM | 2.33 DM | 3.19 DM |
| 10 percent | 2.34 DM | 2.56 DM | 1.63 DM | 2.10 DM | 1.77 DM | 2.33 DM |
| 0 percent | 1.61 DM | 1.75 DM | 1.18 DM | 1.42 DM | 1.18 DM | 1.47 DM |

# Light-Operated Interval Switch

**J. H. Whitaker**
*Assoc. Member ASAE*

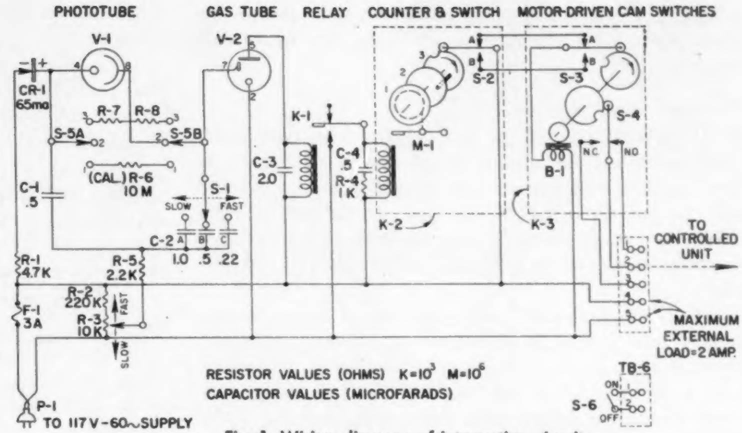



Fig. 1 Wiring diagram of integrating circuit

A LIGHT-OPERATED interval switch (l-ois) has been designed to provide a controller that will operate electrical equipment in relation to light intensity. While the l-ois has been used to control the application of irrigation water automatically in a shade tobacco research project, its most promising use currently appears to be for controlling the mist systems used in the propagation of woody plant cuttings.

It has become common practice to propagate nursery stock cuttings on benches over which mist nozzles have been installed. The mist, applied for a few seconds at a time, at frequent intervals throughout a period of several weeks, prevents the foliage of the cuttings from drying out. Moisture applied in this manner is necessary until the cuttings begin to develop roots, at which time the frequency of the mist application can be reduced and finally the mist omitted entirely as the roots are able to supply the moisture lost by transpiration, from the foliage.

During a period of direct sunshine, plant leaves increase several degrees in temperature even though the air temperature and humidity within the greenhouse may not change appreciably. It is during these periods that mist must be applied frequently in order to compensate for the increased evaporation and transpiration rates. The l-ois modulates the mist application in relation to sunlight and thus reduces the guess work and manual adjustment necessary.

## Principle of Operation

The basic principle of operation of the light-operated interval switch is quite simple. An electronic circuit, including a phototube and a gas discharge tube, operates a magnetic counter which has been modified so that its *tens* wheel operates a microswitch. The gas tube *fires* when the voltage across the capacitor in its starter plate circuit builds up to a critical level. Thus, the frequency of discharge from the gas tube is determined by the level of light intensity falling on the phototube and the size of the capacitor used. Each discharge pulse is registered on the counter, and when 100 pulses have been accumulated, a program timer is started. The timer completes one cycle and then stops until it is again activated by the action of the counter. Within this cycle any *program* of on and off positions of the operating microswitch can be obtained by adjusting the cams on the timer. The result is a repeating operation with a frequency varying with light intensity and a duration determined by cam adjustment.

For example, in bright sunshine, mist applications of 3 sec duration might occur as frequently as every 2 min, while under cloudy conditions the same 3-sec applications might occur as seldom as one-half hour or more apart.

## Construction and Calibration

The parts to build the l-ois can be purchased for less than $60 and can be assembled with the aid of hand tools and light soldering equipment. The entire operating mechanism can be mounted in a galvanized iron chassis about 8 in. on a side. One-half of a ping pong ball serves as a light diffuser.

In operation, it is important that the timer complete its entire program before the counter has accumulated enough pulses to reactivate the timer. For example, if a one-minute timer is used and the counter activates the timer each time 100 pulses have been accumulated, then the maximum pulse rate in bright sunlight should not be over about 80 pulses per minute. Although pulse rate adjustment is provided in the circuit, it will usually be necessary to supplement the filtering action of the ping pong ball diffuser. The use of

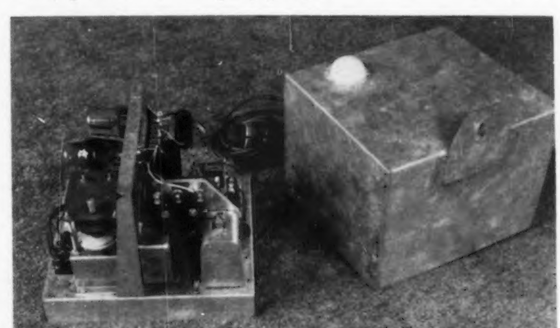


Fig. 2 Operating mechanism can be mounted in a galvanized iron chassis. One-half of a ping pong ball serves as a light diffuser

*An Instrument News Contribution.* Articles on agricultural application of instruments and controls and related problems are invited by the ASAE Committee on Instrumentation and Controls, and should be submitted direct to Karl H. Norris, instrument news editor, 105A South Wing, Administration Bldg., Plant Industry Station, Beltsville, Md.

The author — J. H. WHITAKER — is associate professor, agricultural engineering department, The University of Connecticut, Storrs.

several layers of onion skin paper wrapped around the phototube and held in place with masking tape works well for this purpose.

### Optional Modifications

If the pulse rate and therefore the frequency with which the program repeats becomes too slow with a reduction in light intensity, two resistors, one in parallel and one in series with the phototube, may be switched into the circuit. With a decrease in light intensity these resistors serve to prevent the pulse rate from decreasing as rapidly as with the tube alone.

If the minimum total cycle length desired is over 10 min, and an "on" period of more than one minute is required, then it is necessary to replace the fourth wheel in the counter with a cam instead of the third wheel. This means that 1000, instead of 100, pulses are accumulated per cycle, giving a minimum total cycle time of just over 10 min at a pulse rate of 80 per minute. A 10-min timer is used in this combination and the "on" part of the cycle may be from approximately one-half minute up to 8 or 9 min in length.

A timer with an additional microswitch may be used if it is desired to operate more than one solenoid valve or other device from the same controller. With these two operating switches, it is possible to provide two "on" periods of different lengths. However, the frequency of these "on" periods will be identical.

### Conclusions

Because the integrating action of this circuit works on the basis of a current regulator and a constant voltage (approximately 80 volts will fire the gas discharge tube) it is possible to integrate over a wide range of input values and time intervals with accuracy affected only by the quality of the capacitor and the uniformity of the potential necessary to fire the gas tube.

A light integrator using essentially this same circuit is soon to be marketed, and it seems likely that other applications may be found for this simple and inexpensive circuit, using such current controlling transducers as thermisters or strain gages in place of the phototube.

While the output may end at the counter when only an integral value is desired, the circuit may be extended, as has been done in the light-operated interval switch, to control electrical devices such as solenoids, motors or heaters.

## . . . Hop Harvesting

*(Continued from page 748)*

these investigations which are reported in condensed form as follows:

1. When the weather is good and dry, harvest during early morning hours and late in the afternoon until nightfall.

2 Place the vines carefully on the transport carts and proceed immediately to the machine.

3 Carefully remove the vines from the cart and feed them evenly into the machine.

4 Adjust the speed of the primary and secondary plucking drums to the existing condition of the hops. Operate with the lowest possible speed of the drums.

5 Use skilled and reliable labor only as machine operators.

6 Adjust properly the slant of the tilted conveyor bands. Also control continuously the adjustment of vacuum used for leaf and cluster separation according to the amount of foliage at any time.

7 Use ample manpower on the sorting conveyors. Take care that the clusters are not moved opposite to the operating direction of the sorting band when picking the stem and leaf particles before bagging the hops. Otherwise they may easily be damaged.

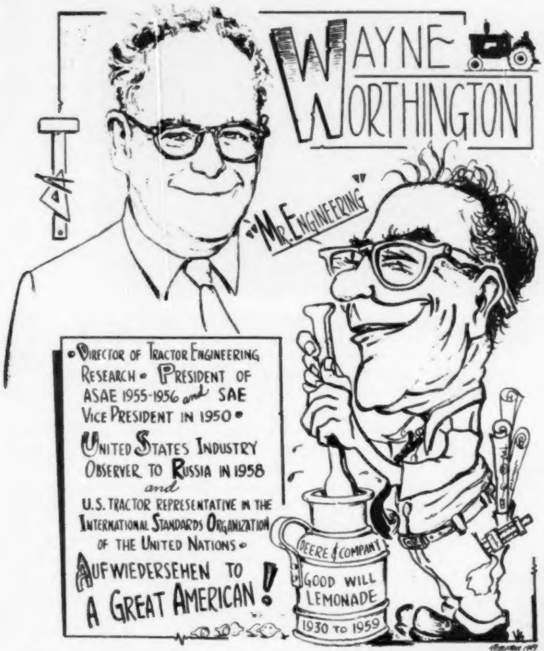
8 When bagged, transport the hops carefully to the kiln.

9 Don't intermix any waste.

10 Don't pack the hops so high that they are too dense on the kiln. Observe and control the kiln drying with great care.

## University of California Buys Rare Books

**The University of California has purchased the personal library of F. Hal Higgins, ASAE affiliate, of Walnut Creek, California, containing a rare collection of some 150,000 books, catalogs, magazines, and pamphlets on the development of agricultural machinery in the United States. There are nearly 1,000 books in the collection, many now out of print, on agriculture and farm mechanization. Dozens of filing cabinets containing early photographs, clippings, advertising circulars, and other material not usually collected that show the development of farm machinery in this country are included. There is also an extensive collection of house organs of equipment manufacturers, many never collected in libraries. Shown looking at a photo of an early tractor *(left to right)* are Roy Bainer, chairman of the agricultural engineering department at Davis; Higgins; and J. Richard Blanchard, librarian at the University of California, Davis.**


# DEERE Honors Leading Agricultural Engineer

**Many gifts and expressions of affection and good wishes were received by Wayne H. Worthington during a retirement party October 31. *(Left to right)* Gust Olson, Jr., general manager (retired), John Deere Waterloo Tractor Works; Barrett G. Rich, chief engineer, John Deere Waterloo Tractor Works; Wayne H. Worthington; J. Waldo Seiple, project engineer, John Deere Tractor Research and Engineering Center; Harley A. Waldon, general manager, John Deere Waterloo Tractor Works; and Edwin W. Tanquary, staff engineer, International Harvester Co. Cartoon at upper left was prepared by Henry Ferguson, project engineer on Wayne's staff**

Wayne H. Worthington, past-president of ASAE, was honored at a party given October 31 at which time his retirement as director of research, John Deere Tractor Research and Engineering Center, Waterloo, Iowa, was announced. His retirement, however, seemingly is only a release from the burden of administrative responsibilities since on November 6 he left the United States to concentrate on his technical and international interests as engineering consultant to the Heinrich Lanz factory at Mannheim, Germany, for John Deere Inter-Continental, S. A. Accepting an overseas assignment perhaps is not too surprising to many of his friends since he has maintained a growing interest in the international development and application of agricultural engineering since the days of his first job as a graduate engineer from Oklahoma State University in 1910. He literally accepted an "assignment to Siberia," as a service engineer for the J. I. Case Co. in Russia, Siberia, and South America.

All of Wayne's business life has been devoted to engineering effort in the tractor and farm machinery industry. He attained prominence and top engineering positions with several important companies prior to his joining the John Deere Waterloo Tractor Works Engineering Department in May, 1930. His initial assignment at Waterloo was supervisor of design and shortly thereafter he was appointed chief of the new design division. His contribution during the development of the Models A, B, and H tractors, introduced to the trade in the early nineteen thirties, was outstanding.

On October 1, 1956, upon the establishment of the John Deere Research and Engineering Center, Wayne was appointed director of research. His vision and enthusiasm for the future have been maintained at high levels through the years and have been responsible for substantial programs for future design and development work.

Wayne has been a member of ASAE since 1921. He was elected a vice-president of ASAE in 1930, a Fellow in 1954, and president in 1955. He was awarded the Cyrus Hall McCormick Medal for outstanding engineering contribution to agriculture in 1954, and the FEI Award in 1958. He was selected last year by the U.S. Department of Agriculture as an industry member of a mission to Russia to observe agricultural practices and to appraise rural economic conditions.

As president of ASAE he was most instrumental in reorganizing the Power and Machinery Division and establishing its Technical Committee. He also spent considerable amounts of his time and effort in effecting the "new look" in cover design and editorial makeup introduced in the January 1957 issue of AGRICULTURAL ENGINEERING.

As of November 1, 1959, Harold L. Brock, member of ASAE, is appointed director of research at the John Deere Tractor Research and Engineering Center to succeed Mr. Worthington. Harold joined the John Deere organization in April, 1959, and has served since that time as assistant director of research. He was associated with the Ford Motor Co. from 1930 until joining Deere. For the period 1940 through 1957, he occupied the position of chief tractor engineer.

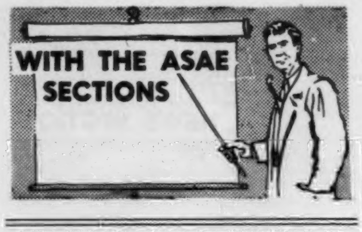
## Five Elected ASAE Fellows and Nine to Life Memberships in 1959

The Council of ASAE, during 1959, elected the following members to the grade of Life Fellow: F. O. Bartel (retired), Spartanburg, S. C.; E. C. Easter (retired), Birmingham, Ala., J. B. Kelley, professor of agricultural engineering, University of Kentucky, Lexington. J. W. Sjogren, professor of agricultural engineering, Virginia Polytechnic Institute, Blacksburg, was elected to the grade of Fellow, as well as Life Fellow, during 1959. Elected to the grade of Fellow during the year are: G. J. Burkhardt, research agricultural engineer, Agricultural Experiment Station, University of Maryland, College Park; C. L. Hamilton, Bureau of Docks and Yards, U.S. Navy, Washington, D.C.; A. V. Krewatch, extension agricultural engineer, University of Maryland, College Park; and E. T. Swink, head, agricultural engineering department, Virginia Polytechnic Institute, Blacksburg. Those elected to the grade of Life Member in 1959 are: J. P. Fairbank, agriculturist emeritus, University of California, Davis; C. H. Hopkins, architect and civil engineer, Balboa, Calif.; P. B. Potter (retired), Blacksburg, Va.; T. A. Russell, Hyatt Bearings Division, General Motors Corp., Chicago, Ill.; and J. A. Waller, Jr. (retired), Blacksburg, Va.

## Section M — Engineering — Program Arranged for AAAS Annual Meeting

Section M (Engineering) of the American Association for the Advancement of Science has arranged a program entitled "National and International Aspects of

*(Continued on page 756)*




## ASAE MEETINGS CALENDAR

December 16-18 — WINTER MEETING, Palmer House, Chicago, Ill.

January 15—QUAD CITY SECTION, American Legion Club, Moline, Ill.

February 1-3 — SOUTHEAST SECTION, Birmingham, Ala.

February 12 — MICHIGAN SECTION, Detroit area. Further details later.

March 4 — QUAD CITY SECTION, American Legion Club, Moline, Ill.

March 24-25 — SOUTHWEST SECTION, Washington-Youree Hotel, Shreveport, La.

April 8-9 — MID-CENTRAL SECTION, Hotel Robidoux, St. Joseph, Mo.

April 14-15 — PACIFIC COAST SECTION, Arrowhead Conference Center of the University of California.

April 22 — QUAD CITY SECTION, American Legion Club, Moline, Ill.

June 12-16—ANNUAL MEETING, Ohio State University, Columbus, Ohio.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph, Mich.

**Interested in Oregon State College attendance at the Pacific Northwest Section annual meeting in Ephrata, Wash., J. B. Rodgers, head, agricultural engineering department, OSC, managed to round up 10 of the 16 attending graduates (and ASAE members) in the above photo. They are *(left to right)* Marvin N. Shearer, Willard E. Salmon, Clarence J. Hurd, Ivan C. Branton, Robert B. Morland, Creighton N. Gilbert, Wilbur L. Griebeler, John E. Dixon, Lawrence R. Swarner, and Andrew H. Schmidt**

### Quad City Section

The Quad City Section has elected John W. Ackley, chairman; Robert G. Morgan, vice-chairman; G. Harvey Shriver, vice-chairman; Martin A. Berk, secretary; and William M. Adams, treasurer, for the coming year.

### Chicago Section

Following are the newly elected officers of the Chicago Section for the coming year: Thomas E. Clague, chairman; J. H. Ebbinghaus, vice-chairman (programs); Donald P. Storm, vice-chairman (publicity); Gordon P. Barrington and Robert W. Whitaker, co-vice-chairmen (outlying districts); and Ernest W. Walpole, secretary-treasurer.

### Connecticut Valley Section

The Connecticut Valley Section has elected the following slate of officers for the coming year: H. E. Gulvin (Eastern State Farmers Exchange), chairman; W. C. Wheeler (agricultural engineering department, University of Connecticut), vice-chairman; D. N. Stiles (Connecticut Light and Power Co.), jr. vice-chairman; L. F. Whitney (agricultural engineering department, University of Massachusetts), secretary-treasurer.

### Central Illinois Section

The annual fall meeting of the Central Illinois Section was held on November 5 at the Sinorak, Bloomington, Ill., with 61 members and guests in attendance at the smorgasbord dinner. University of Illinois, agricultural engineering students, arriving after the dinner, increased the attendance to a total of 75. The first part of the evening's program consisted of a demonstration on the safe handling of petroleum products by J. W. Tyslan of the Ethyl Corp. The remainder of the program included a talk by Martin T. Ekovich, assistant state conservationist, Soil Conservation Service, concerning the Watershed Protection and Flood Prevention Act. He discussed the federal aid available under the Act and explained how costs are shared by the federal government and local communities.

### Virginia Section

The Virginia Section held its annual meeting on October 30 and 31 in the agricultural auditorium, Virginia Polytechnic Institute, Blacksburg, Va. The program on Friday included discussions on land forming, developing seeps and springs, changes in engineering curriculums, and a series of talks on the engineering aspects of hog production in Virginia. Speakers from out of the state were: Ray M. Ritchie, Jr., extension agricultural engineer, North Carolina State College; H. B. Puckett, Agricultural Research Service, USDA, University of Illinois; and L. H. Skromme, chief engineer, New Holland Machine Co., New Holland, Pa.

A banquet on Friday evening climaxed the day of technical discussions, with approximately 70 members and guests in attendance. The featured speaker was L. H. Skromme, national president, whose subject was "Let Us Cherish Our Heritage," the theme of which was built around craftsmanship, honesty, freedom, and courage. Four Virginia Section members were honored at the banquet when L. H. Skromme presented P. B. Potter and J. A. Waller, Jr. with life membership certificates, and J. W. Sjogren and E. T. Swink with certificates in recognition of their election to the grade of Fellow.

At the business meeting on Saturday morning, the following members were installed to lead the Virginia Section in the coming year: J. H. Lillard, chairman; E. T. Blackwell, J. B. Burford, and J. P. H. Mason, vice-chairmen; and J. P. Walker, secretary-treasurer.

### Correction

The item in the November issue concerning the annual meeting of the Pacific Northwest Section on October 14 to 17 and listing the newly elected officers erroneously stated that Richard D. Appel has been elected as fourth vice-chairman. This should have read: David H. Appel, fourth vice-chairman.

### Kentucky Section

During its fall meeting on October 30-31 at Mammoth Cave, the Kentucky Section elected the following officers for the coming year: T. C. Shirley (head, member service department, Kentucky State Association of Rural Electrical Cooperatives), chairman;

*(Continued on page 756)*


**J. W. Tyslan of the Ethyl Corp. *(left)* gives demonstration on the safe handling of petroleum products and Martin T. Ekovich, assistant state conservationist, Soil Conservation Service *(right)*, addresses the annual fall meeting of the Central Illinois Section in Bloomington, Illinois**

## It's modern to design with concrete

In prestressed concrete the engineer has a completely new and up-to-date building material. Its properties allow the design of buildings with long unobstructed spans and minimum beam depths. These are both important in securing the flexibility of use demanded in today's farm structures.

This is the fourth of a series of reports showing design techniques with concrete applied to specific parts of a building. The explanation that follows shows why prestressed concrete is an ideal material for long span roofs. The table gives typical span lengths for double tee sections.

# CONCRETE ROOFS...

## "long spans a specialty"

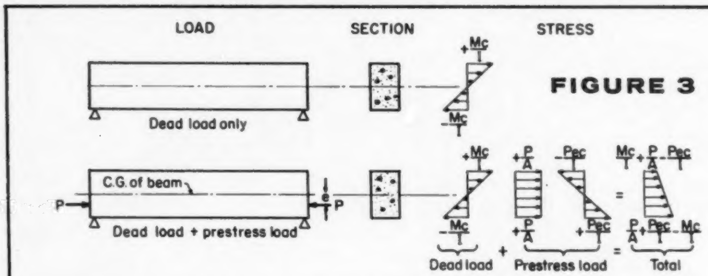



FIGURE 3

Resisting Moments and Spans for Prestressed Concrete Double Tee Sections

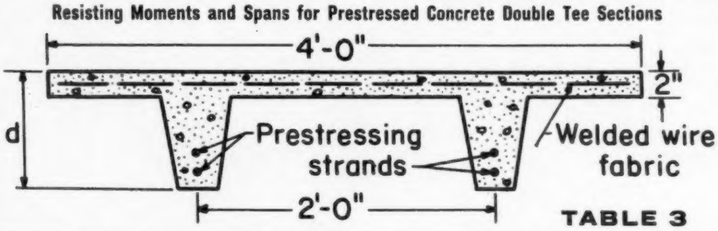



TABLE 3

| Depth, d, Inches | Weight lb. per sq. ft. | Approximate Range of Carrying Capacity: Resisting Moment* ft.-kips per Double Tee | Approximate Range of Carrying Capacity: Allowable Clear Span for 25 psf Snow Load (ft.) |
|---|---|---|---|
| 8 | 38 | 9 to 20 | 16 to 24 |
| 10 | 41 | 12 to 37 | 18 to 34 |
| 12 | 44 | 16 to 55 | 20 to 40 |
| 14 | 47 | 20 to 71 | 22 to 44 |

**including dead load moment*

Prestressed concrete lends itself to construction of clear spans of unusual length. One of the reasons is that through prestressing, a stress pattern can be induced that completely counteracts the dead load stress of the beam. Thus the member is essentially weightless so far as its stress pattern is concerned. The entire strength of the beam is available to carry live loads.

Fig. 3 shows how this remarkable property is produced in a rectangular beam. By varying the magnitude of the prestress force, "P", and its distance from the center of gravity of the beam, "e", a total stress of the desired distribution can be obtained. Prestressed members have compressive stresses built into the bottom fibers. This cushion of compression counteracts the tensile stresses that are produced when a live load is applied. Through prestressing, concrete is utilized only in compression—a property in which it excels.

A tee, I, or box shape utilizes prestressed concrete more effectively than a rectangular section. Table 3 shows the general range of resisting moments available with double tee roof sections. The exact moment that a section will carry depends on the amount and location of the prestressing steel. The range of spans shown are for snow loads of 25 lb. per sq. ft. Manufacturers of prestressed roof sections furnish engineering guidance on selection of the member to fit the individual need.


**Lincoln I. Opper** has been named manager of product engineering for the Dayflex Plastic Hose Division of The Dayton Rubber Co. The position was created by rapid expansion of the Dayflex hose line in recent years. Mr. Opper, formerly a belt engineer with the company's industrial division, will act as liaison between the sales and production departments. His duties will include the design and engineering for special product developments. He joined the company in 1950 as an assistant V-belt engineer.

**Harry B. Pfost,** upon completion of requirements for a Ph.D. degree in agricultural engineering from Michigan State University, has accepted the position of professor of flour and feed milling industries at Kansas State University, Manhattan. He was an associate professor of agricultural engineering at Alabama Polytechnic Institute from 1946 to 1949, where he also earned an M.S. degree in 1948. From 1953 to 1956 he was division engineering manager of the Green Giant Co., and was product planning analyst at Ford Motor Co. during 1956 and 1957.

**Charles D. Roice** has retired from International Harvester Co., Chicago, Ill., and is now located in Hotchkiss, Colo. He came to IH in 1924 as a salesman at Salina, Kans., and progressed through the years successively in the capacities of district sales manager, Topeka, Kans.; assistant managing director of IH of Australia, Pty. Ltd., Melbourne; district sales manager at Salina, Kans., Dallas, Texas, and Philadelphia, Pa.; managing director, IH of Great Britain, Ltd., London, England; assistant director general of European Operations, Brussels, Belgium; director general, European Operations, Chicago; senior vice-president and president, IH of Canada, Ltd., Hamilton, Ontario, Canada; and director, foreign operations, Chicago, Ill. From 1957 until his retirement, he was director of farm equipment product planning.

**Charles A. Logan,** a member of ASAE since 1929 and superintendent of the agricultural center at Beltsville, Md., recently received a Commendation, in recognition of a long and active career in soil and water conservation work, by the Soil Conservation Society of America. The presentation was made during the organization's 14th annual meeting, August 28, in Rapid City, S. D.

**V. Subba Raju,** formerly head of the agricultural engineering department, Indian Institute of Technology, Kharagpur, India, has taken a position as superintending engineer in the department of agriculture for the Andhra Pradesh government, in Hyderabad-Deccan, India.

**Joshua J. Fenn** has returned to his native country, India, where he is associated with the agricultural engineering department of the Agricultural College and Research Institute, Vellayani, Kerala, India. He has been in the United States doing work on an M.S. degree in agricultural engineering at the University of Tennessee, Knoxville.

**Robert T. Lorenzen** has accepted a position as assistant professor of agricultural engineering at Cornell University, Ithaca, N. Y. He successively has been connected with the agricultural engineering departments of the University of Wisconsin, Madison; University of California, Davis; and Colorado State University, Fort Collins.

Lincoln I. Opper

Harry B. Pfost

**James H. Willson,** president of Athens Plow Co., Athens, Tenn., was elected 1959-60 president of the Southern Farm Equipment Manufacturers at their ninth annual meeting Sept. 16-18 at Greensboro, N. C. He has been an ASAE member since 1937.

**James F. Merson,** department head of the agricultural engineering division, California State Polytechnic College, San Luis Obispo, received special recognition at the 41st annual California Farm Bureau Federation Convention in Los Angeles in November. He received a 30-year service pin, honoring him for his longtime contributions to California agriculture.

**Carl Neitzke** has been appointed assistant director, Farm Division of the National Safety Council, where he will work with farm leaders and organizations, farm safety specialists, agricultural colleges and state farm safety committees. Prior to this appointment he was extension specialist in farm electrification at the University of Wisconsin.

**Harry F. Blaney,** irrigation engineer, Agricultural Research Service, USDA, has returned to Los Angeles recently after completing a 5-month trip inspecting irrigated areas in the near and far east countries. Three months were spent in evaluating irrigation research and water utilization in Israel for the U.S. International Cooperation Administration. Mr. Blaney conferred with irrigation engineers in Rome, Athens, Israel, Pakistan, India, Thailand, Japan, and Hawaii.

**Ronald C. Carver** advises that he is now associated with Caterpillar Tractor Co., as a design engineer in the research department. He was formerly an engineering trainee, with John Deere Co. in Waterloo, Iowa.

**E. A. Ffolkes** has returned to Kingston, Jamaica, British West Indies, where he is connected with the Ministry of Communications and Works, in the public works department of the irrigation and drainage division. He had been in the United States since 1957, after being awarded a scholarship by the Jamaican government to undergo practical training and observation of irrigation and drainage practices in the U.S., and affiliated with the Agricultural Research Service of the U.S. Department of Agriculture.

**David W. M. Haynes** has left England recently and is now located in Northern Nigeria, West Africa, at the Regional Research Station in Samaru, Zaria.

**Ivan J. Balls,** formerly with Plant Protection, Ltd. in Surrey, England, advises he is now affiliated with Wharfedale Wireless Works, Ltd. in Yorkshire, England.

*(Continued on page 763)*

## NECROLOGY

**B. Parker Hess,** Fellow of ASAE, passed away on October 26, following a prolonged illness. Well-known for his ASAE activities, he had been associated with Westinghouse Electric Corp. for the past 29 years. Born October 7, 1895, he was raised on a farm in southwestern Ohio where he was a 4-H Club member. For three years prior to entering Ohio State University he operated the family farm. In 1922 he received a B.S. degree in agricultural engineering from OSU, and in the same year joined ASAE. During the seven years following graduation, he was successively a salesman for Oliver Chilled Plow Works; county agricultural agent in Brown County, Ohio; in charge of the Ohio Committee on the Relation of Electricity to Agriculture; and developer of the Marysville, Ohio, experimental rural electrical line. In 1929, he re-entered Ohio State University, earning a degree in electrical engineering in 1930. That same year he joined Westinghouse in the rural electrification division, becoming manager of that group in 1939. In 1941, he was named sales engineer in charge of electrical apparatus for the farm machinery, food, glass and ceramic industries, in which capacity he served until his death. His activities in ASAE included: chairman of the Electric Power and Processing Division, a member of the ASAE Council; and chairman of the Extension Committee on Motion Pictures. He was elected to the grade of Fellow in 1953. He was active in the Masons, including the Consistory and Shrine in Pittsburgh. Photography had been more than a hobby with him as hundreds of pictures which he took of electricity at work on farms have been used in Westinghouse and other publications. He is survived by his wife, Cordelia, and two daughters. Burial was in Columbus, Ohio.

B. Parker Hess

**Herman S. Poorbaugh** passed away on September 19 at his home in York, Pa. The cause of death was attributed to a heart attack. He was the owner of Quarry Service, which supplied parts for machinery used in quarries. Prior to his going into business for himself, Mr. Poorbaugh was associated with the Quarry Castings and Supply Division of Donegal Mfg. Corp., Marietta, Pa., as general manager, and previously was agricultural consultant for R. H. Sheppard Co., Hanover, Pa. He had been a member of ASAE since 1949. He is survived by his wife, Eva.

Herman S. Poorbaugh



**. . . News**

TEAR OUT AND PUNCH AS INDICATED FOR YOUR FILE

## . . . News

*(Continued from page 751)*

Systems Units—Operation SCUDS (Simplification, Clarification, Unification, Decimalization, Standardization)" for presentation at its annual meeting December 26 to 31 at the Morrison Hotel, Chicago, Ill. This program is scheduled for December 28 and 29 and will consist of four sessions: I — The confusion of chaos in units; II — Public education vs. the consumer public; III — Problems of design, manufacture and commerce; and IV — The look to the future.

### 1960 Nuclear Congress

The 1960 Nuclear Congress will be held April 3-8 at the New York Coliseum. Sunday, April 3, will be Student Day, featuring the theme "Your Future and Atomic Energy". An "All Congress" session will be held on Monday morning, devoted to the question "What will future development of nuclear energy demand from engineers?" The remainder of the five-day Congress will be rounded out with the following sessions: 4 Reactor; 3 Environment; 2 Materials and Components; and one each for Standards, Isotope Applications, and Radiation Processing. Three Aircraft Nuclear Propulsion sessions also will be included, one of which will be a joint Nuclear Congress - SAE program.

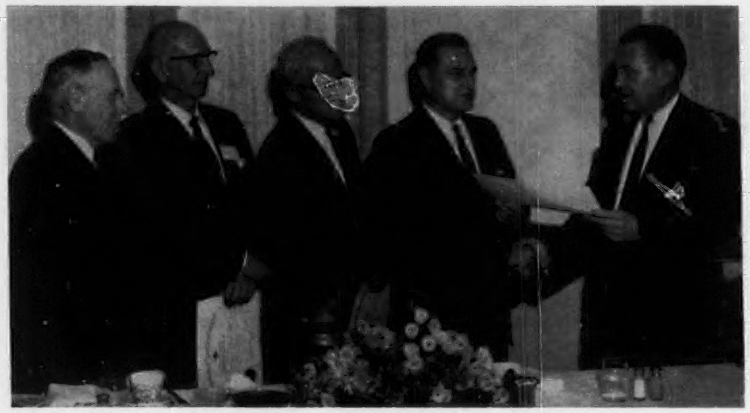
### API Changes Name

President R. B. Draughon has announced that effective January 1, 1960 the name of Alabama Polytechnic Institute will be changed to Auburn University. This action was approved by the Institute's Board of Directors at its fall meeting and was authorized by the State leglislature in November.

### Books for Asian Students

"Books for Asian Students," one of many Asia Foundation projects, has sent over a million and one-half selected books and journals to more than 2,000 Asian schools, colleges, universities, libraries, and other organizations. The Asia Foundation is a non-profit, non-political organization founded by private American citizens and incorporated in the state of California. Through its 17 offices in 15 countries of Asia it works to strengthen Asian educational, cultural, and civic activities, with private American assistance.

The following types of materials, published before 1945 and in good condition, are greatly needed: Elementary, secondary, and college level textbooks; classic literature and other standard works. Also needed are scholarly, scientific, and technical journals in runs of five years or more. Technical books other than the latest revised editions also are acceptable, if published after the 1945 date limit. The Foundation will pay transportation costs from the donor to San Francisco and thence to Asia upon presentation of a postal receipt for publications sent by educational materials postal rate to: Books for Asian Students, 21 Drumm St., San Francisco 11, Calif. If the shipment is large, it may be sent by motor freight collect (not Railway Express or moving van).



**Four ASAE Virginia Section members were honored at the annual section meeting banquet at Virginia Polytechnic Institute, Blacksburg. Shown left to right are: J. W. Sjogren, J. A. Waller, Jr., P. B. Potter, and E. T. Swink, with L. H. Skromme, ASAE national president, presenting the certificates. J. W. Sjogren and E. T. Swink were presented with certificates in recognition of their election to the grade of Fellow, and P. B. Potter and J. A. Waller, Jr., received life membership certificates**

## EVENTS CALENDAR

December 26-31—*American Association for the Advancement of Science,* 126th Meeting, Chicago. Section M (Engineering) will meet December 28-29. Section O (Agriculture) will meet December 28-31. Contact AAAS, 1515 Massachusetts Ave., N.W., Washington 5, D.C., for additional information.

December 28-31 — *American Association for Advancement of Science, Section O — Agriculture,* Exhibit Hall (South), Morrison Hotel, Chicago, Ill. Write to: Howard B. Sprague, Secretary, Section O, AAAS, Dept. of Agronomy, Pennsylvania State University, University Park, Pa.

January 11-15 — *Society of Automotive Engineers* 1960 Annual Meeting, Sheraton Cadillac and Statler Hotels, Detroit, Mich. Further information may be obtained by writing to SAE headquarters at 485 Lexington Ave., New York 17, N. Y.

January 14-15 — *Annual Cotton Production Conference,* Memphis, Tenn., jointly-sponsored by the Cotton Mechanization Conference and the Farm Equipment Institute. Write to FEI, 608 S. Dearborn St., Chicago 5, Ill., for information.

January 20 — *Farm Equipment Institute* Winter Meeting, Hotel Peabody, Memphis, Tenn. Contact FEI, 608 S. Dearborn St., Chicago 5, Ill., for details.

January 21-22—13th Annual *Southern Farm Forum,* Roosevelt Hotel, New Orleans, La., sponsored by the Agricultural Com-

January 25-28 — *Plant Maintenance and Engineering Show,* Convention Hall, Philadelphia, Pa. Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y., will furnish additional information.

January 25-29 — *Stress Measurement Symposium,* Arizona State University, Tempe, Ariz., sponsored by Strain Gage Readings. Further details may be obtained by writing to Peter K. Stein, Editor, Strain Gage Readings, 5602 E. Monte Rosa, Phoenix, Ariz.

February 1-3 — *Association of Southern Agricultural Workers,* 57th Annual Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala. For information write to C. E. Kemmerly, Jr., Secretary-Treasurer, Louisiana State University, Baton Rouge, La.

February 1-4— *American Society of Heating, Refrigerating and Air-Conditioning Engineers,* Semiannual Meeting, and the *Second Southwest Heating and Air-Conditioning Exposition,* Memorial Auditorium, Dallas, Texas. To obtain details contact ASHRA headquarters, 62 Worth St., New York 13, N. Y.

March 1-6 — *31st Salon International De La Machine Agricole (Agricultural Machinery Show),* Paris, France. Additional information will be furnished by the Commercial Counselor, French Embassy, 610 Fifth Ave., New York 20, N. Y.

April 3-8 — *1960 Nuclear Congress* with *1960 Atomic Exposition,* New York Coliseum, New York City. Additional information may be obtained from Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

April 18-20 — *Seventh National Watershed Congress,* Washington, D.C. Write to The National Association of Soil Conservation Districts, Service Dept., League City, Texas, for further details.

April 25-29 — *American Welding Society's* 41st Annual Convention and Welding Exposition. Convention will be held in the Biltmore Hotel, and the Welding Exposition in the Great Western Exhibit Center, Los Angeles, Calif. For further details write Information Center, AWS, 33 W. 39th St., New York 18, N. Y.

## . . . With ASAE Sections

*(Continued from page 752)*

Orval R. Love (agricultural engineer, Purina Feeds, Louisville, Ky.), program vice-chairman; Robert E. Cherry (Kengas, Inc., Owensboro, Ky.), membership vice-chairman; Frank K. Downing (East Kentucky Rural Electric Cooperative Corp., Winchester, Ky.), public relations vice-chairman; and Kermit C. Mills (extension agricultural engineer, University of Kentucky, Lexington, Ky.), secretary-treasurer.

### Washington, D. C. Section

The Washington, D. C. Section will hold a meeting on Friday, December 11, at the USDA South Building (Room 6962), Washington, D. C. It will be a noon luncheon meeting at which H. F. Miller, chief, harvesting and farm processing research branch, AERD, USDA, Beltsville, Md., will speak on the progress of agricultural engineering research in harvesting and farm processing equipment. The remainder of the program will be devoted to an explanation of some of the intricacies of modern harvesting and farm processing equipment by a professional researcher, and examples and illustrations taken from his staff's projects throughout the United States.



for full loading without interior handling;

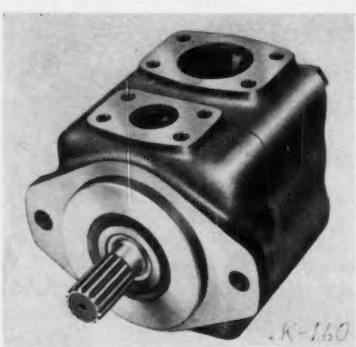

## High-Tension Locking Fasteners

Russell, Burdsall & Ward Bolt and Nut Co., 103 Midland Ave., Port Chester, N. Y., announce new flanged high-tension locking screws and nuts which it claims provide superior locking performance and eliminate the need for washers in assembly of metal products. These one-piece fasteners lock with both ratchet-like teeth and high thread tension that is said to provide a

high ratio of off-torque to on-torque ratio. Carburized teeth on flanges of the one-piece screw and nut are angled on the advancing side to allow low-friction tightening but are vertical on the back side to prevent loosening. In addition, a circular groove in the flange increases diaphragm action, flexing the flange as teeth are imbedded upon seating to help maintain residual tension in the fasteners. The manufacturer claims that reuseability of these products is high on drilled or punched holes regardless of surface condition. These fasteners are available in sizes from No. 6 to ⅜ in.

## Hydraulic Vane Pump

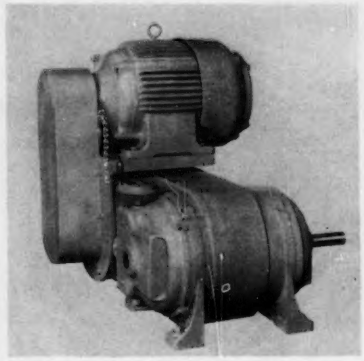
Vickers, Inc., Div. of Sperry Rand Corp., Detroit 32, Mich., announces its new series 45-vane pump. Three models of this pump deliver 52, 63 and 75 gpm at 2000 rpm



and 2000 psi. The pump housing accommodates any of the three pumping cartridges which permits change of delivery rate. All wearing parts of the pump are incorporated in the replaceable cartridge so that complete pump overhaul is accomplished simply by replacing the cartridge.

## Separate Motor Mechanical Variable Speed Drive

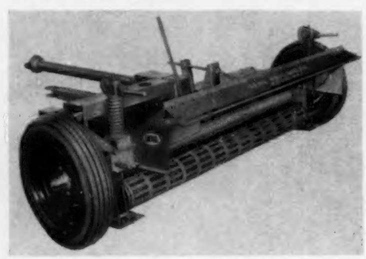
Sterling Electric Motors, Inc., 5401 Telegraph Road, Los Angeles 22, Calif., has developed a mechanical variable speed drive featuring separate motor construction and horizontal assembly. The new drives reportedly meet J.I.C. standards, offer compact design due to the "piggy-back" construc-



tion, and provide a wide selection of infinitely variable output speed ranges through selection of the V-belt and timing belt. Specifications include: ½ through 30 hp; output speeds from 4660 to 1.2 rpm; speed variations from 2:1 to 10:1; and special electrical and mechanical modifications are also available.

## Crush-Crimp Hay Conditioner

Gehl Bros. Manufacturing Co., West Bend, Wis., has introduced a new hay conditioner designed to crush-crimp the hay with what is described as "leaf-saver" action. The machine features a specially-ribbed rubber roll and a steel roll to begin hay curing and drying immediately. Simple, off-center spring levers enable the operator



to quickly release pressure on the roll without changing the adjustment. The pressure can be set to meet varying crop conditions and permits wood bits or similar debris to pass between the rolls without damage to the conditioner. An easy to regulate fluffer directs the hay back on the field with the stems in the air. The overall width of the machine is 103 in. picking up a 7-ft swath.

## Grain Storage and Utility Building

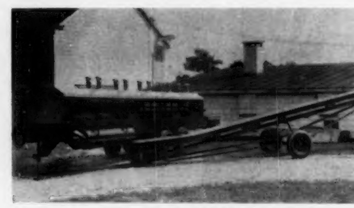
Stran-Steel Corp., Division of National Steel Corp., Detroit 29, Mich., has announced its new Grain-Master "44" low-priced multipurpose building designed to store both grain and machinery. The building is 44 ft wide, 16 ft high at the peak, with lengths in 16-ft bays and provides storage for 15,000 to 50,000 bu of grain.

For grain storage, the new building has double walls of steel; steep pitch roof and convenient loading hatches at the roof peak for full loading without interior handling; all-steel three-piece door bulkhead; and the company's Air Meter to cool the grain. Movable partitions can divide the interior into grain storage and machinery storage. The ribbed steel wall and roof panels are color coated at the factory with a double protective layer of vinyl-aluminum. Excellent heat reflective qualities of a white coated roof are claimed.

## Grain Drier Uses Infrared Heat

Rite-Way Fabricating and Engineering Inc., 15 W. First St., Monroe, Mich., has announced the development of a mobile push-button controlled infrared grain drier designed to automatically remove moisture from all types of small grains and beans. The manufacturer reports that the drying process is entirely new and involves controlled infrared heat energy from propane, natural or manufactured gas. The use of gas with a ceramic mat as a generator causes emission of infrared heat energy.

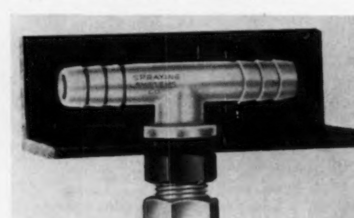
The complete unit is 23 ft long, 5 ft wide, and 6 ft high. Grain is fed on an endless



belt of corrosion-resistant wire mesh, leveled to a given thickness and then passed under five infrared gas generators for a distance of 22 ft. At the discharge end a helicoid screw transfers grain to a drum type conveyor where it is air cooled to a proper temperature for storage. Capacity of the drier is reported to be 800 to 1500 bu per day. The motor operates off any ordinary electrical outlet or the unit can be supplied with a gasoline a-c generator.

## Nylon Spray Nozzles

Spraying Systems Co., 3226 Randolph St., Bellwood, Ill., announces a new type of spray nozzle that permits fabricating of a spray boom from an angle iron instead of piping. The nozzles are mounted in holes drilled in an angle iron at desired intervals and the hose shanks connected by hose make up the complete boom. The nozzles are supplied with double and single-hose shank



bodies for inside and end positioning on the boom. The complete nozzle consists of hose shank, nozzle body, cap and strainer body made of nylon, with strainer screen in stainless steel and orifice tips in either aluminum or stainless steel. The assembly is held in position on the angle iron by a lock nut. Advantage claimed for the nylon is that it provides resistance to almost all agricultural chemicals including balanced mixed fertilizers.

## MANUFACTURERS' LITERATURE

**Literature listed below may be obtained by writing the manufacturer.**

### Diesel Engines

*Allis-Chalmers Mfg. Co., Engine-Material Handling Div.,* Milwaukee 1, Wis. — A new catalog (BU-540) describes the design, construction and mechanical advantages of two recently introduced Models 21000 and 16000 diesel engines. This catalog is complete with illustrations, including charts, graphs and cutaway views of the engines to visually describe the new units. Line drawings show how they serve as basic equipment for every major field of power.

### Deep-Groove Ball Bearing Bulletin

*Hoover Ball and Bearing Co.,* 5400 S. State Rd., Ann Arbor, Mich. — A 12-page bulletin describing the company's deep-groove ball bearings. Hoover standard-width deep-groove bearings are made in extra light, light, medium, and heavy series. They may be open, equipped with shields or contact seals, and are offered with or without snap ring. Deep-groove bearings of cartridge design or with felt seals are also available. Dimensions, loads and other application data for all these bearings are included in the Hoover Bulletin No. 110.

### Torquemeter

*Metron Instrument Co.,* 432 Lincoln St., Denver 3, Colo. — A 2-page bulletin describing the company's series 85 torquemeters for measuring dynamic torques. These torquemeters are designed to cover ranges from 5 to 250 oz-in full scale on shafts turning from 50 to 12,000 rpm. Accuracy is claimed within 2 percent of full scale.

### Brochure on Improved Tractor

*Caterpillar Tractor Co.,* Peoria, Ill.—Production and mechanical advantages of the new D9 Series E tractor and features of the new power shift transmission are given in a 6-page, illustrated brochure. (Form 33544). Improvements to the tractor shown in brochure include a new transmission, an increased flywheel horsepower, a new equalizer bar, a new hydraulic control and an improved undercarriage.

### Gutter Cleaners

*H. D. Hudson Mfg. Co.,* 589 E. Illinois St., Chicago 11, Ill. — A 16-page booklet describing its line of gutter cleaners for dairy barns which describes in detail the company's two types of gutter cleaners — the chain-type cleaner in which a chain with flights travels through the gutter and elevator system in a continuous path, and the belt-type cleaner that operates on the belt-conveyor principle.

### Cotton Booklet

*International Harvester Co.,* 180 N. Michigan Ave., Chicago 1, Ill. — An 8-page illustrated booklet, "Growing Cotton for Efficient Machine Harvesting," has been issued. Topics covered include proper land selection, crop residual disposal, seed bed preparation, cotton varieties, planting, thinning, fertilizing insect control, weed and grass control, defoliation, harvesting, and ginning.

### Gears

*Illinois Gear & Machine Co.,* 2108 N. Natchez Ave., Chicago 35, Ill. — A 12-page, 2-color, illustrated bulletin (No. 26 IG) entitled "This is Illinois Gear." Manufacturing facilities and gear specifications are described.

## TECHNICAL PAPERS

Following is a list of papers, presented during the 52nd Annual Meeting of the American Society of Agricultural Engineers at Cornell University, Ithaca, N. Y., June 1959, of which complete copies are still available and have not been published or listed in the Technical Paper Abstracts column of AGRICULTURAL ENGINEERING. ASAE members may obtain copies of these papers without charge by returning order forms supplied upon payment of membership dues. Nonmembers (and members requesting more than 10 copies) may purchase papers at 50 cents each to cover carrying charges from the American Society of Agricultural Engineers, St. Joseph, Mich.

| Power and Machinery Division | Paper No. |
|---|---|
| Soil Deformation and Compaction During Piston Sinkage — Walter H. Soehne, W. J. Chancellor, and Roy H. Schmidt | 59-100 |
| Compaction and Slippage Effects of Forage Harvesting Machinery—M. M. Boyd and R. W. Kleis | 59-102 |
| Compaction as Viewed from the Farm—Herbert Stapleton | 59-103 |
| The Plateau Profile Planter—J. G. Porterfield, David G. Batchelder, and E. W. Schroeder | 59-105 |
| Similitude in Studies of Tillage Implement Forces—H. E. McLeod | 59-106 |
| Objective Analysis Motivates Advanced Manure Spreader Design —Alfred L. Neuhoff | 59-107 |
| Pressure Distribution Between a Smooth Tire and Soil — G. E. VandenBerg and W. R. Gill | 59-108 |
| Radial Ply Tires (Panel) | |
| Tractive Characteristics— I. F. Reed and P. J. Forrest | 59-110 |
| Operating Characteristics— T. J. Thaden | 59-111 |
| Durability Characteristics— R. L. Wann | 59-112 |
| Progress in Mechanizing Citrus Fruit Harvesting in Florida — Glenn E. Coppock and Pierre J. Jutras | 59-118 |
| Safe and Efficient Fertilizer Placement—W. L. Nelson | 59-119 |
| Fertilizer Placement for Small Grain — C. M. Hansen, L. S. Robertson, and R. F. Dudley | 59-120 |
| Deep Tillage and Fertilizer Placement in Georgia—C. E. Rice and H. M. Norris | 59-121 |
| Physical Removal of Radioactive Surface Contamination from Agricultural Land, a Progress Report — R. L. Menzel and Paul James | 59-124 |
| Optimizing Farm Tractor Design and Use—An Approach—K. L. Pfundstein | 59-126 |
| Mechanizing the Peanut Crop in Georgia—Tillage Through Harvesting and Curing — James L. Shepherd | 59-136 |
| Machinery and Methods of Producing and Harvesting the Virginia Type Peanut—G. B. Duke | 59-137 |
| Herbicide Application Methods and Equipment Used in Cotton — C. H. Thomas and W. K. Porter, Jr. | 59-141 |

| Soil and Water Division | Paper No. |
|---|---|
| Underground Sprinkler Systems—King Ewing | 59-202 |
| Effects of Surface Loads on Plastic-Lined Mole Drains—Philip L. Manley | 59-203 |
| Characterizing Irrigation Water Use by Means of Efficiency Concepts—Lyman Willardson | 59-204 |
| Detecting Deeply Penetrating Rain-water with a Neutron Scattering Moisture Meter—Paul R. Nixon and G. Paul Lawless | 59-207 |
| Erosion Characteristics of Rainfall as Measured by Soil Pans — George R. Free and Philip L. Manley | 59-210 |
| Beach Erosion Control Techniques —G. M. Watts | 59-211 |
| **Electric Power and Processing Division** | |
| Farm Load Studies in New York Area—Morris H. Lloyd | 59-300 |
| Quality Control of Hay—James H. Oliver | 59-309 |
| An Instrument for Measuring the Smut Content of Wheat—Gerald S. Birth | 59-313 |
| Parallel Thermocouple Circuits and Their Application to Agricultural Engineering Temperature Measurement Problems — Henry D. Bowen | 59-315 |
| A Peanut Sheller for Grading Samples: An Application of Statistics in Design and Testing—James W. Dickens and D. D. Mason | 59-317 |
| **Farm Structures Division** | |
| Influence of Milk Code Requirements on Planning Farm Dairy Buildings—Harry Eby | 59-402 |
| Let's Re-Examine Our Rural Waste Disposal Recommendations — George Amundson | 59-408 |
| The Development of a Packaged Poultry House—Merle L. Esmay | 59-409 |
| Moisture Effect on Granular Friction of Small Grain—Robert T. Lorenzen | 59-416 |
| **Public Lands and Public Works** | |
| Basic Nature of Soil—Roy Simonson | 59-505 |

## . . . Members in the News

*(Continued from page 754)*

**Melvin A. Hagood,** who has been county extension agent with the extension service at Washington State University, is now doing graduate work and assistant teaching in the irrigation department at the University of California.

**Etlar A. Henningsen** recently has accepted the position of senior project engineer with John Deere Spreader Works at East Moline, Ill. Previously, he was affiliated with the McCormick Works of International Harvester Co. as assistant chief engineer, product engineering.

**Donald A. Kesinger** is now located in Hesston, Kans., as product engineer with Hesston Mfg. Co. Prior to this change he was connected with the engineering department of International Harvester Co. in East Moline, Ill.

**B. F. Muirheid** has returned from India, where he had been soil conservation advisor for International Cooperative Administration since 1957. He advises that he has joined the staff of Wilson and Anderson, Consulting Engineers, in Champaign, Ill.

**D. A. Kiffer,** who until recently has been chief engineer with Chamberlain Corp., Waterloo, Iowa, is now located in Wayzata, Minn. and is employed by Streator Industries as a design engineer.

**Edward R. Pierce** has accepted a position as development engineer with the Lycoming Division of Avco Corp. at Stratford, Conn. He formerly was connected with Hamilton Standard Division of United Aircraft Corp. as an equipment engineer.

**Henry A. Steele** has accepted a position with Perfection Electrical Products, Inc. in Nashville, Tenn. He was previously associated with Layne Control Co., Cleveland, Miss., as an irrigation engineer.

**Samuel J. Strebin** advises that he has organized his own company in Valencia, Venezuela, under the name of Strebin and Company. The primary interests of the company are making technical studies, especially for large irrigation projects, colonization, soil surveys, farm plans, land development, etc.

**Theodor W. Suberkropp,** formerly a salesman for New Holland Machine Co., is now affiliated with TPS Ford Tractor Co., Inc., as manager in Salina, Kans.

**D. E. Washburn** recently has been appointed vice-president and general manager of the Haverly Equipment Division, John Wood Company at Royersford, Pa. He formerly was manager of the farm equipment department of United Cooperatives, Inc., Alliance, Ohio.


**The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.**

**Anderson, J. Forrest** — Test engr., Minneapolis-Moline Co. (Mail) 653 36½ Ave., N.E., Minneapolis 18, Minn.

**Balch, Charles D.**—Elecn. advisor, Appalachian Electric Cooperative. (Mail) 1007 Burnett St., Jefferson City, Tenn.

**Bartosik, Alexander**—Lecturer, dept. of livestock farm mechanization, Poznan's Polytechnic. (Mail) Katedra Mechanizacji Hodowli Politechniki Poznanskiej, Poznan, ul. Kornicka 10, Poland

**Beyer, Sherman O.**—Des. engr., Minneapolis-Moline Co. (Mail) 37 15th Ave., N., Hopkins, Minn.

**Bickford, John C.**—Experimental field engr., J. I. Case Co. (Mail) 2041 Oaklawn, Davenport, Iowa

**Brummel, Henry A.**—Owner and mgr., H. A. Brummel Co., P.O. Box 201, Cedar Lake, Ind.

**Buckley, Hubert E.**—Irrigation engr., Carlon Products Corp., High Springs, Fla.



**Christopher, John G.**—With the U.S. Air Force. (Mail) 2124 N. Nevada, Colorado Springs, Colo.

**Churchill, Donald B.**—421 Haslett St., East Lansing, Mich.

**Clark, Griffith S.** — Asst. to vice-president in charge of sales, Homasote Co., Box 441, Trenton, N. J.

**Culpepper, W. S.**—State conservation engr., (SCS) USDA. (Mail) 407 Phyllis Ave., Columbia, Mo.

**Dalton, John C.**—Work unit engr., (SCS) USDA, 660 W. 17th St., Merced, Calif.

**Edmunds, Henry**—Agr. attache, British Embassy, Washington 8, D. C.

**Ford, W. Warner** — Civil engr., watershed planning party, (SCS) USDA, 1409 Forbes Rd., Lexington, Ky.

**Glass, Emmett F.** — Des. engr., New Holland Machine Co., Div. of Sperry Rand. (Mail) 115 N. Ninth St., Akron, Pa.

**Gregg, Carroll L.**—Electrical advisor, Holston Electric Cooperative. (Mail) 307 Gibson St., Rogersville, Tenn.

**Harrison, Timothy A.** — Asst. to the president, The Union Fork and Hoe Co., 500 Dublin Ave., Columbus 15, Ohio

**Haslanger, Clarence O.** — Mgr., Fruit Belt Electric Cooperative, Cassopolis, Mich.

**Henry, Elvin F.** — Soil scientist, Federal Housing Administration. (Mail) 100 Meadow View Rd., Falls Church, Va.

**Hodek, Jiri G.** — Des. engr., New Holland Machine Co., New Holland, Pa.

**Howe, Ralph S., Jr.** — Eng. mgr., Fafnir Bearing Co., 37 Booth St., New Britain, Conn.

**Hughes, Roberta M.**—Engr. draftsman, Res. and Eng. Center, International Harvester Co. (Mail) 127 Woodstock, Clarendon Hills, Ill.

**Jacobson, Gene A.** — Des. engr., Line Material Industries, 12th and Madison Sts., South Milwaukee, Wis.

**Jacoby, Shmnel L. S.** — Res. asst., irrigation dept., University of California. (Mail) 619 C St., Davis, Calif.

**Jensen, Vearl L.** — Consulting engr., Morrison-Quirk Grain Corp., Box 745, Hastings, Nebr.

**Kobayashi, Torao** — Pres., Kyoritsu Noki Co., Ltd. (Mail) 254, 5-chome, Omiyamae, Suginami-ku, Tokyo, Japan

**Lettson, Clarence** — Engr., Clay Equipment Corp. (Mail) 2115 Olive St., Cedar Falls, Iowa

**Maity, Shaktpada** — Birla College of Agr., West Bengal, India, on leave as asst. prof. of agr. eng., University of Missouri. (Mail) 1312 Anthony St., Columbia, Mo.

**Marks, Henry M.**—Sales, Farm Fans, Inc. (Mail) 8652 Washington Blvd. E. Drive, Indianapolis, 20, Ind.

**Mentzer, John E.** — Instr., ext. agr. eng., agr. eng. dept., Purdue University, Lafayette, Ind.

**Morris, Donald S.** — Rural power use advisor, Carolina Power and Light Co. (Mail) 220 S. Elm St., Asheboro, N. C.

**Mortensen, Gerald R.** — Engr., John Deere Tractor Res. and Eng. Center. (Mail) 609 W. Parker, Waterloo, Iowa

**Muckel, Dean C.**—Irrigation engr., (ARS) USDA, P.O. Box 180, Berkeley, Calif.

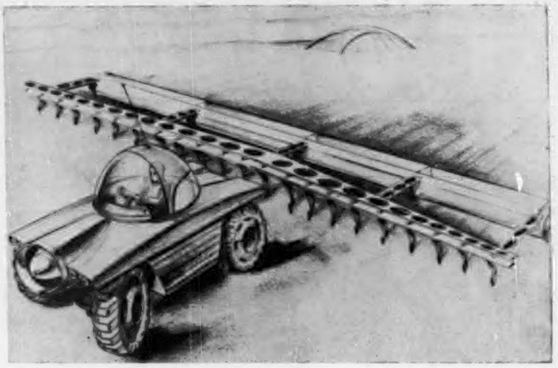
**Ogden, C. B.** — Owner, Ogden Groves, Box 307, Groveland, Fla.

**Olson, William L.** — Instr., agr. eng. dept., University of Minnesota, 204 Agr. Eng. Bldg., St. Paul, Minn.

**Richards, Glenn E.** — Expeditor, J. I. Case Co. (Mail) Wilton Junction, Iowa

*(Continued on page 766)*

# CRYSTAL BALL GAZING



The Industrial Design Group of International Harvester Co. has relayed to the drafting board what its more prognostic designers believe are in store for future farmers during the next 15 to 20 years. Shown is a tractor pulling a 20-row swath which they predict will be one of the marks of the future progressive farmer. The tractor would be equipped with a 200-hp gas turbine or a free-piston engine, and would have 4-wheel drive and 4-wheel steering. The company reports that an International TD-24 crawler tractor fitted with a gas turbine engine is currently being tested at an IH proving ground and a free-piston engine is being tested at the company's Melrose Park, Ill., Works

Designated as the Typhoon II, the Tractor and Implement Division of Ford Motor Co. has developed a working model, slightly less than one-half normal size, of what their futuristic-minded stylists call a "dream tractor".

Virtually everything the farmer may need for comfort and efficiency has been designed into the units as essentials. Inside the all-weather cab the stylists envision such unique features as a two-way telephone, weather forecasting equipment, a food warmer and refrigerator, and a small television screen which would enable the driver to view the operation of rear-mounted implements. Hydraulic power would be used to turn all four wheels independently, to adjust the distance between the wheels, and to increase the clearance under the tractor.

South Bend Division of Curtiss-Wright Corp. has announced that the Model 2500 Curtiss-Wright Air-Car, shown above in a prototype model, will be manufactured soon. The 4-passenger, 300-hp vehicle reportedly travels over any unobstructed terrain, over water, swamp or mud at a height of from 6 to 12 in. Prototypes of an "Air-bus" and "Air-Truck", for carrying passengers and freight, are in process.

## PERSONNEL SERVICE BULLETIN

Note: In this bulletin the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this bulletin, request form for Personnel Service listing.

**Positions Open—May**—O-77-914, 49-915, 97-919. **June**—O-124-920, 131-922, 132-923, 135-926, 136-927, 137-928, 140-929, 140-930. **July**—O-170-931, 177-932, 186-933. **August**—O-215-936, 217-938, 218-939, 212-940, 220-941, 223-942, 228-943, 228-944, 231-946, 231-947, 231-948, 247-949, 259-950, 259-951. **September**—O-265-952, 219-954, 264-955, 275-956, 285-957, 277-958, 286-959. **October**—O-315-960, 323-961, 323-962, 324-963. **November**—O-327-964, 328-965, 341-966, 320-967, 346-968, 353-969, 360-970, 352-971, 358-972, 361-973.

**Positions Wanted—May**—W-83-15, 84-16, 100-22. **June**—W-188-27, 112-28, 123-29. **July**—W-154-31, 196-33, 190-34. **August**—W-199-35, 210-36, 224-37. **September**—W-249-40, 258-41, 245-43, 267-44, 269-45. **October** — W-307-47, 321-49. **November** — W-330-50, 378-51, 284-52, 335-53, 336-54, 343-55, 329-56, 363-57.

### NEW POSITIONS OPEN

**Agricultural Engineers** (several) for graduate assistantships in research in an eastern state university. Choice of technical field within agricultural engineering or food engineering. BS degree in any field of engineering or technology field of agriculture. Opportunity to work with young, well-qualified staff, excellent facilities, and aggressive program. Salary $2,730 first year, $2,860 second year. O-378-974

**Agricultural Engineer** of assistant or associate rank for research in the field of power and machinery at southeastern land grant college. Research experience desirable but not mandatory if personal qualifications and education are adequate. Applicant must have an interest in research, ability to do original thinking, and be able to work with other staff members. PhD desirable, MS minimum. Excellent opportunities in developing research program with original ideas in a young and growing department. Salary open. O-384-975

**Design Engineers** (several), for research, design, and development of tillage, planter, green hay harvesting, and farm materials handling implements with established broad-line manufacturer in Midwest. Age 20-35. BSAE with mechanical option, or BSME. Experience range from none to 8 years with farm implement manufacturer. Able to work with and to lead people. Excellent opportunity to advance in product engineering and in related fields. Salary open. O-386-976

**Product Engineer Division head** (2 positions), to administer division in farm equipment field, answering to chief product engineer. Established broad-line manufacturer in Midwest. Age 30-40. BSAE, BSME, or equivalent. Experience 5-10 years as implement designer. Able to lead design engineers. Excellent opportunity with progressive manufacturer. Salary open. O-387-977

**Instrument Technician** to use strain gage and stresscoat equipment, and other laboratory and field farm implement product design test equipment. Established broad-line manufacturer in Midwest. Age 25-45. Minimum of one year college, or equivalent. Experience 6 months or more. Will also consider applicant with other electronic experience and desire to work with farm equipment. Able to work with product design engineers. Excellent opportunity with progressive farm equipment manufacturer. Salary open. O-387-978

**Sales Engineer** for work with original equipment manufacturers, to encourage purchase and application of precision ball bearings to their products. Area—Chicago and 100 mile radius. Age 32 or under. BS degree. Engineering or sales experience with a machinery manufacturer. Initiative, integrity and average or better technical ability. Excellent opportunity in area from which the company has selected three sales managers in the past 15 years. Interview by appointment only. Salary up to $7,500. O-389-979

**Rural Engineers** (3) for service in Ghana, providing technical advice and training to Ghanean officials and workmen on varied rural construction projects. Age 30-55. BSAE or BSCE. Experience of 3 to 5 years in rural construction. Able to adjust to foreign environment. Opportunity to broaden experience record. Openings to be filled in January and February 1960. Salary $6,000-7,500, and additional benefits. O-370-980

**Agricultural Engineer** with emphasis on farm construction and rural electrification. Position requires individual with drafting ability, sales personality, and a practical approach to farmstead improvements. Work involves calling on sales prospects, designing and preparing costs of projected improvements, then supervising the actual construction work as completed by company employed construction crew or subcontractors. Salary open. O-394-981

**Agricultural Engineer**, instructor or assistant professor rank, for teaching and research in farm structures and utilities, in a western state university. Age 23-35. MSAE preferred. May consider BSAE interested in working toward MS. Some teaching experience desirable. Interest and ability in teaching and research. Advancement depending on accomplishment. Original appointment for 11 months. Position to be filled between June 1 and September 1, 1960. Salary $5,300-7,000, depending on education and experience. O-404-982

### NEW POSITIONS WANTED

**Agricultural Engineer** for design, development, research, or extension in electrification, product processing, or crop drying, with college, manufacturer, or processor. Any location. Agreeable to some travel. Married. Age 28. No disability. BSAE, 1958, Kansas State University. Enlisted service in USAF before graduation, with promotions to Sgt. Electronics school one year, and experience 3 years as technician and supervisor on electro-mechanical bomb-navigation systems. Part-time employment as research assistant while in college. Sales engineer over one year. Farm background. Available January 1. Salary open. W-366-58

**Agricultural Engineer** for design, development, or research in farm structures or product processing with industry or public service, Eastern United States or Midwest. Single. Age 48. No disability. BSME, 1933, Kiev Polytechnic Institute. MA (Geodetic Surveying) 1957, Asia Institute (Teheran, Iran). MSAE 1959, Univ. of Massachusetts. Construction supervision and route surveying, Iran. 12 years. Mechanical engineer, TransIranian Railroad, 5 years. Construction project engineer, Near East Foundation, 4 years. Graduate assistant instructor 3 years. Available March 1, 1960. Salary open. W-390-59

**Agricultural operations** man for design, development, or research in power and machinery or soil and water field with industry, in North or South America or United States possessions. Will travel. Read and write Spanish fluently. Singe. Age 27. Artificial right eye no handicap for most work. BS in mechanized agriculture, Rutgers University, 1958. Varied part time and summer work experience. Farm mechanization supvervisor with fruit company in Honduras since graduation. Available January 1960. Salary open. W-388-60



### . . . Membership Applicants

*(Continued from page 764)*

**Schachtmeister, Sydney C.** — Sanitarian-dir., div. of sanitation, Berrien Co. Health Service. (Mail) P.O. Box 365, St. Joseph, Mich.

**Seals, James A.** — Field engr., J. I. Case Co., 2117 State St., Bettendorf, Iowa

**Setterlund, Sidney N.** — Des. engr., Minneapolis-Moline Co. (Mail) R.R. 1, Box 283, Mound, Minn.

**Shah, Chandra M.** — Asst. agr. engr., Government Agr. Workshop, Talkatora, Lucknow, U. P., India. (Mail) c/o J. T. Kyle, dir., Agr. Machinery Administration, Reginia, Sask., Canada

**Simmons, Michael S.** — Work unit engr., (SCS) USDA. (Mail) 426 N. Pine St., Madera, Calif.

**Smith, Vernor** — Mgr., Tri-County Electric Co-op., Box 348, Portland, Mich.

**Voytovich, Nick H.** — Dist. mgr.-sales, Massey-Ferguson, Inc. (Mail) 3300 36th Ave., N. E., Minneapolis, Minn.

**Webb, Everett M.** — State supervisor, teacher training for vocational agr., Washington State University. (Mail) 2008 N. Monroe, Pullman, Wash.

**Wolf, Wayne W.** — Graduate student, University of Nebraska. (Mail) 1201 J St., Lincoln, Nebr.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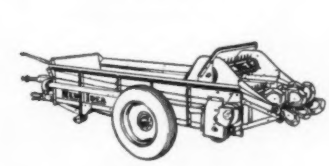

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*Advertising Manager:* HARMON MULBAR, 420 Main St., St. Joseph, Mich. YUkon 3-2700

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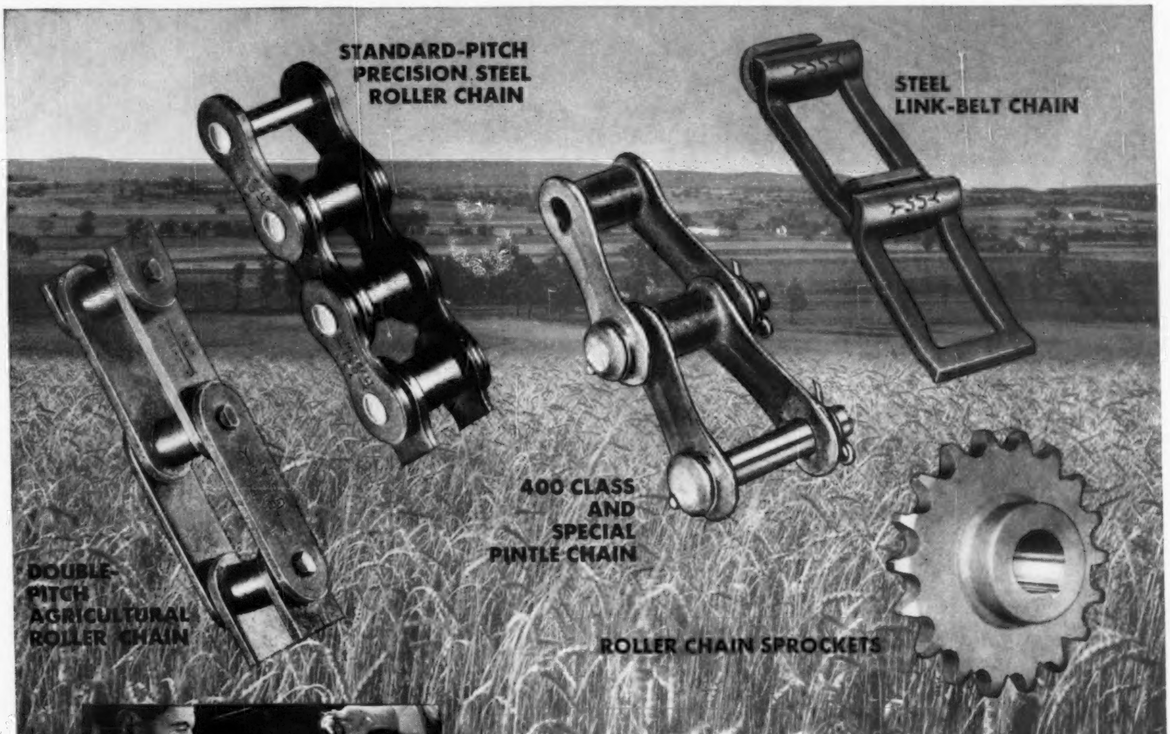
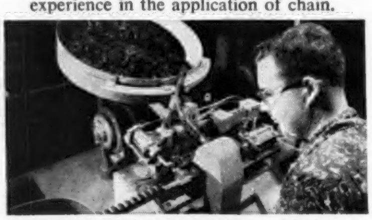



**EXPERT ENGINEERING**—Link-Belt maintains an engineering staff of unsurpassed experience in the application of chain.



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